Evaluating the Recreation Service Recovery: Evaluation of Prince William Sound User Experience

Final Report

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Study History: The Prince William Sound User Experience project was initiated in summer 2007 to evaluate user activities, impacts, conflicts, and experiences (including concerns and perceptions) in Prince William Sound (PWS). This project was established to provide land and resource managers with insight into the recovery of recreation/tourism services in the aftermath of the Exxon Valdez Oil Spill (EVOS). It was initiated to define use distribution, use levels, and experience of recreationists in the Sound and tiers to a suite of projects launched by the Chugach National Forest (CNF) to evaluate the dynamics of human use in PWS as they relate to recovering injured resources and services.

Abstract:
This study evaluates dispersed recreation in Prince William Sound in terms of spatial distribution and intensity as well as user experience. The two major empirical components of this study were (1) kayak and boat-based transect observations of vessel traffic to determine use levels, and (2) a trip diary questionnaire to evaluate user profiles in terms of activities, impacts, conflicts, and experiences. These two components were complimented by secondary validation efforts including computer simulation of visitor traffic and targeted focus group evaluation. We found a strong correlation between destinations reported by questionnaire respondents and use mapped by observers on systematic transects. Thus a combination of these two datasets was used to generate predictive GIS raster surfaces of seasonal recreation use intensity. An overwhelming proportion (95%) of respondents reported experiences that were as, or better than, expected with 95% also reporting they would return to Sound. Only 10% of respondents reported negative encounters with other users and none reported displacement due to encounters. Finally, when asked about remnant oil, only two of 171 respondents noticed lingering oil. The results of our study will help managers understand use patterns as well as interactions between recreation use and recovering resources and services.

Key Words: Alaska, displacement, focus group, lingering oil, Prince William Sound, recreation distribution, user experience, kayak, boat

Project Data: Data were collected using field-based observations, questionnaire responses, and narrative response from targeted focus groups. Transect observation data and subsequent density predictions are maintained as GIS layers. Questionnaire and narrative responses are maintained in tabular databases. Upon completion of the project the data will be housed at the Chugach National Forest, Supervisor's Office, Anchorage Alaska. Contact Aaron Poe apoe@fs.fed.us or (907)-743-9500 to request access. Selected GIS data layers are also available through: http://tinyurl.com/33y994q

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Table of Contents

List of Figures **Page No.**

List of Tables

Evaluating the Recreation Service Recovery: Evaluation of Prince William Sound User Experience

EXECUTIVE SUMMARY

The project provides a contemporary analysis of user experience in Prince William Sound in order to: a) evaluate existing management situation to determine if users are experiencing the qualities/attributes for which managers have planned; b) assess the recovery of the recreation/tourism service, which was impacted by the Exxon Valdez oil spill (EVOS) and currently listed as "not fully recovered" by the Trustee Council; and c) describe human use patterns and understand the potential for displacement resulting from competition between user groups (i.e., injured services, like subsistence and recreation tourism) as well as evaluate the intensity of overlap with resources injured by the spill. The project evaluates user activities, impacts, conflicts, and experiences (including concerns and perceptions) in the Sound. It provides much needed insight into the recovery of recreation/tourism services and understanding of the current spatial and temporal patterns of use. Improved understanding of both the experiential and distribution dynamics of recreation will provide land and resource managers with tools to evaluate potential impacts to injured resources and human services.

Our study evaluating recreation user experience has three methodological components: Transect Surveys, Recreation User Profile Questionnaires and Recreation Focus Groups. It employs a variety of spatial analytical techniques to summarize use patterns and make predictions about use dynamics based on behavior data collection components.

Transect surveys were executed during spring, summer and fall between 2007 and 2008 using paired teams of observers aboard motorized vessels in spring and fall and kayak-based paired observers during summer. Observers continually mapped the locations of vessels, shore parties and aircraft encountered along the transect and kayak-based crews compiled similar data from fixed shore observation points in combination with their survey efforts. The distance of encounters and closest approach were also recorded.

We also distributed 1,377 recreation user questionnaires to recreation users departing from Whittier, Valdez and Cordova during the summer of 2008. This survey posed questions about motivations, desired opportunities, satisfaction with recreation experience relative to expectation, and encounter dynamics; it also asked respondents to log their trip using a map document diary. Additionally, reported use locations from a 2005 trip diary study targeting recreation users in the Sound were evaluated. Questionnaire and trip diary reported use locations were compared to empirically identified use locations from transect and shore-based observations. Lastly the software Recreation Behavior Simulator was used to simulate potential use futures in Prince William Sound according to behavioral inputs collected from survey questionnaires.

Questions regarding varying levels of use density were posed to focus groups comprised of hunters, recreational power boaters, and kayakers using the Level of Sustainable Activity framework of inquiry. Focus groups were organized for inquiry sessions in the communities of Cordova, Valdez and Anchorage. They were presented with representative human use scenarios for three different sub-regions within the Sound known to have varying levels of existing use based on prior studies. They were asked to provide perspectives on the use levels presented as they related to their *ideal, expected,* and *maximum tolerable* scenarios of use for three different types of users.

A total of 4,172 km and 4,205 km of transects were completed during spring and fall respectively. Kayak-based observers conducted one-time inventories during summer for a total of 2,923 km of transects. Transect efforts totaled 108 days worth of sampling between 6/28/2007 and 10/4/2008. Multiple crews of observers logged over 1,600 hours of combined transect and shore observations mapping the locations of over 3,100 encounters with other users. We found that the vast majority (~96%) of encounters with other groups of users happen on water and the majority of those (ranging from 66-80% depending on observers mode of travel) happen at distances >1000 m.

We were able to net 341 questionnaires from Whittier, Valdez and Cordova for a 25% total response rate which was consistent across all three ports of distribution. The majority of respondents were accessing the Sound by small motorized boat (65%), followed by kayak and motor yacht. These three categories of users comprised 90% of survey respondents. The top three primary motivations for destination choice included: *good fishing* (40%) *glacier viewing* (21%) and *wildlife viewing* (19%), with only 10% reporting that seeking solitude was a primary motivation for destination choice. When asked to identify the most sought after recreation opportunities in the Sound, people ranked *enjoying natural beauty* most highly, followed by *spending time with family and friends* and *fishing*.

Respondents were overwhelmingly satisfied with their recreation experience in Prince William Sound with 95% stating they would return and that their experience either met (23%) or exceeded (72%) their expectations. Over 90% of users reported no negative encounters with other groups and no respondents reported being displaced from desired use locations as a result of encounters with other users. Only 2 of 171 respondents reported seeing any sign of lingering oil from the spill, with another 170 respondents failing to answer the question.

The locations of 3,703 summer use points reported from diaries and questionnaires were found to have a strong positive ($r = 0.77$) correlation with 977 locations mapped during summer transect sampling efforts. This correlation was used as a basis to pool use locations from trip diaries/questionnaires with locations mapped during transect surveys. These points were pooled by season and used to produce use intensity prediction surfaces in the form of point density interpolation rasters in ArcGIS. These rasters allowed characterization of overall use in the Sound at the sub-regional level.

We conducted eight focus group sessions in Cordova, Anchorage, and Valdez with a total of n=62 participants from three user types. When comparing all three focus groups it is apparent hunters have the highest requirements for solitude and the lowest tolerance for competition. Because hunters are generally in the Sound in the spring and fall and therefore do not overlap the main summer recreational boating season, few conflicts are seen between hunters and kayakers or hunters and other recreational boats. Kayakers are generally tolerant of other kayakers because of the quiet mode of transportation and strongly shared values of low impact recreation but were less tolerant of small motorized boats because of the noise, speed, wakes and the impact motors have on quiet and solitude. Further kayakers felt that small motorized boats offered some competition for shoreline campsites. Kayakers are more tolerant of the larger motor yachts and sailboats because these boats are self contained and generally travel further from shore (ie., outside their typical travel lanes). Recreation boaters were the most tolerant of other users and their satisfaction seemed to depend the least on solitude.

We feel this study has defined a useful baseline for future comparison of both recreation use distribution and quality of recreation experience. This study defines spring, summer, and fall patterns of use that can be used as a baseline to explore recreation use overlap with biophysical resources and other human uses in Prince William Sound. We also establish useful techniques (including trip diaries, transect mapping and focus groups of local user communities) for managers to consider in future monitoring of recreation dynamics in the Sound and similar environments. Our predictions about human use were corroborated by a contemporary effort to identify Human Use Hotspots in Prince William Sound. The tight correlation of our systematic transect survey with user-reported locations suggest that the trip diary approach should be useful for evaluating future use distribution in the Sound. Significant limitations include an inability to gain broad insights into the hunting community in Prince William Sound, a group likely to have distinct sensitivity to potential increases in use. Further limitations in use mapping result from an attempt to complete a one time inventory of the majority of the region as opposed to repeat survey efforts that could return confidence intervals around use estimations.

Our study underscores the importance of managing for a landscape where wilderness qualities (e.g., natural beauty, plentiful wildlife for viewing, fish and game for harvesting and access to solitude) are available as part of the overall recreation experience. It does however demonstrate that other experiences such as simply viewing glaciers and spending time with family and friends are key aspects to the recreation experience in Prince William Sound. The successful recovery of recreation in the Sound is likely dependent on recognizing and facilitating key recreation opportunities sought by users in the region while maintaining a spectrum of available wilderness experiences.

The overall satisfaction with recreation experiences achieved, and desire to return, was very high, with survey respondents reporting little conflict with other user groups. We can infer from our transect observations that this overall satisfaction is linked to the infrequency of encounters and the substantial spatial separation during encounters afforded in this vast setting. Our investigation failed to identify a clear link between user satisfaction and relative levels of use though certainly our focus groups for hunters, and to a lesser degree kayakers, suggests that increasing amounts of specific user types can be troubling.

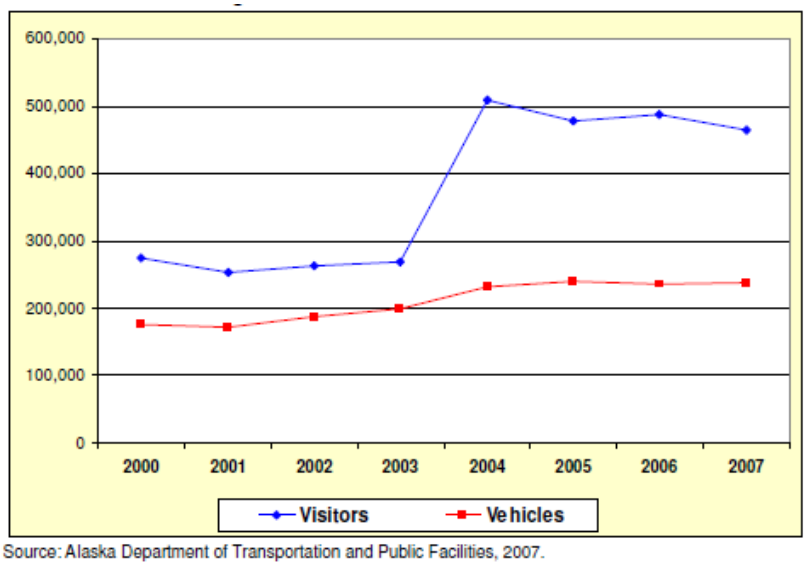
Given that there are some key experiences sought by recreationists in the Sound and the system that is not in "crisis" mode in terms of conflict, crowding or other social impacts, we recommend planning approaches that identify a few key issues and attemp to make systematic progress on them. We submit that attempts at addressing key issues should focus primarily on assessing, managing, and engaging with private recreationists as they constitute the majority of use in the region. This is problematic as these users typically have little connection or relationships with land and resource managers. Further, in many cases their direct use of the uplands may only account for a small portion of their trip; though certainly their activities have a potential social effect on those lands. Due to the vast extent of the PWS region, opportunities for managers to engage these users are limited to ports of entry. This suggests that indirect management efforts in terms of education or management actions that passively effect, direct or deflect use (ie., campsite hardening or other low impact facility options and outreach efforts identifying areas where more use is appropriate) are likely the best for this system.

Managers should attempt to foster more local citizen involvement in reaching out to visitors to the region. Our experience with individuals in our focus groups highlighted a perceived disparity in behavioral norms between *local* Sound residents and other residents of Alaska, as well as visitors, who may have less familiarity with traditions of use in the region. Managers should attempt to share the perspectives and advice of locals in best use practices that can be directed at newer users of the Sound. Such an effort could be combined with collecting systematic input on emerging issues in the region from local experts like those that we brought together in focus groups.

Much in wilderness/wildland recreation research and management focuses on evaluating or limiting numbers of individuals using the landscape in order to predict and reduce the social impacts. Our work highlights some of the complexities that can be missed by such approaches of singular focus. In the Sound, perceptions about encounters seem to have more do with expectations, behaviors exhibited and witnessed, as well as the specific opportunities desired by different groups of recreationists. We suggest that future efforts attempting to assess quality of experience in Prince William Sound focus on understanding recreation behavioral norms and user expectations as approaches to further elucidate potential stressors on recreation experience.

INTRODUCTION

In the twenty years since the Exxon Valdez oil spill (EVOS), Prince William Sound (PWS) has experienced numerous changes. The spill itself impacted and disrupted the resources and human services in the Sound. For example, it is believed that recreation/tourism services were redistributed from oil impacted areas of the Sound to areas of the Sound that had previously experienced little use (Hennig and Menefee 1995). Over the past decade, the Sound has also experienced increased human use (Colt *et al.* 2002). The growth of the recreation/ tourism sector statewide has been accompanied by improved access to the Sound. In the western Sound in particular, the opening of the Whittier access road in 2001 has led to both increased personal and commercial recreation/tourism use (Fay 2008). Figure 1 reveals an increase in vehicles and a dramatic increase of over 200,000 visitors coming to Whittier between 2003 and 2004.



Source: Alaska Department of Transportation and Public Facilities, 2007.

Figure 1: Number of vehicles and numbers of visitors to Whittier from 2000-2007; the Anton Anderson Memorial Tunnel opened the town to private vehicle traffic in 2001.

The first spatially explicit effort to evaluate human use patterns in Prince William Sound was completed by Murphy et al. (2004) noting that, "Increased human activity in PWS may affect the recovery of species injured by EVOS". That seminal project integrated GIS generated maps of current and projected human-use patterns with maps of the distribution of injured resources to identify potential areas of conflict and disturbance but was limited to western Prince William Sound.

This project adds depth to that study's spatial model, and describes the nature of user-resource experiences in the Sound as well as evaluates the potential for conflict between user groups. It also provides an excellent opportunity to assess the recovery of the recreation/tourism human service, also injured by the spill and still listed as "not fully recovered" by the EVOS Trustee Council.

This is no small matter, as the recreation/tourism sector is an increasingly important part of local and regional economies of the Sound. According to the Alaska Department of Community and Economic Development's Alaska Economic Information System "As destinations in Southeast Alaska and at Denali have become more crowded, the Valdez-Cordova and Wrangell St. Elias areas have been identified as the 'next frontier' of the tourism industry." (http://www.commerce.state.ak.us/dca/AEIS/AEIS_Home.htm)

Additionally, outdoor recreation is an important part of the Alaskan lifestyle. While many have chosen to live in Alaska to maintain such a lifestyle, out of state and international visitors that annually converge on the Alaskan landscape to hunt, fish and experience the wildness pose a threat to sustaining such a lifestyle. There is growing concern within the agencies mandated to oversee the management of this landscape in areas like the Sound that increased competition and rapid growth in sport hunting and fishing, both commercial and private as well as ongoing subsistence activities may be threatening the ability of the resource to sustain such use. Of equal concern is whether the very wilderness experiences that Alaskans and visitors are seeking are not equally being threatened. Assuming recreational use levels continue to increase in PWS (eg., kayaking, wildlife viewing, pleasure boating, hunting, fishing, camping etc.) it is inevitable that encounter levels and associated impacts may also increase and visitor conflicts could arise.

As an EVOS Federal Trustee, the Chugach National Forest (CNF) is focusing its efforts to gain an understanding of the spatial and temporal patterns of recreation use in the Sound in order to better inform management objectives and ensure they are based on current and projected levels of use. In order to compliment this information land and resource managers also need to consider a risk management approach. This approach would help determine if level of use may exceed quality of service standards relative to recreation experience, safety, social, economic and environmental criteria. An important component of this effort involves working with the recreation users to acquire an understanding of the relationship between quality of service, behavioral norms, expectations, and appropriate use densities for groups using PWS. This information provides valued insights for exploring use allocation in the Sound by balancing high quality recreation experience with long-term protection of the landscape.

Limited examples of this type of work have been completed in the Sound. While there are studies going on to capture biological and human use information necessary for improving the management of CNF lands within PWS, there is nothing specifically evaluating the

quality of visitor experience. A recent study by Wolfe et al. (2006) entitled "Monitoring and analysis of recreational boat use in sensitive wildlife areas in Prince William Sound, Alaska: A simulation approach" measures recreational boating use of PWS. This study evaluates the dispersed recreation use in PWS by giving travel diaries to visitors along with a survey to capture information necessary for characterizing the visitor. This study documented the presence of distinct travel corridors and destination areas used by three different users groups – kayakers, recreational boaters, hunters and anglers, it does little to capture information on visitor experience. Combining these travel corridors aids in identifying locations and intensity of recreation use in prime destinations. This baseline model provided some indication of dispersed use levels across the Sound and identified some human activity "hotspots". Our study compliments and expands upon these works relative to understanding the quality of recreation experience in order to better understand motivations for locations of use and related variables from the perspectives of visitors to the region.

Relevance to 1994 Restoration Plan Goals and Scientific Priorities

Recreation and tourism is a class of human services that is not yet fully recovered from the impacts of the 1989 spill (EVOS Trustee Council 2010). According to the 1994 Restoration Plan, the *Recreation Service* will not be considered fully recovered until the resources upon which it depends are recovered. There is growing concern within the federal agencies mandated to oversee land and resource management in PWS that increased competition and rapid growth in commercial and independent human use may be threatening these resources; particularly those injured and still recovering from EVOS upon which the recreation/tourism depends. Of equal concern is whether the very recreation experiences that Alaska residents and visitors are seeking are being threatened by increases in use. As recreational use levels increase in PWS (eg., kayaking, wildlife viewing, pleasure boating, hunting, fishing, camping etc.) it is inevitable that encounter levels will also increase. There is concern that user conflicts could arise as a result and thus the quality of recreation as a human service under EVOS Trustee Council purview may similarly decrease. Lastly this study directly evaluates recreation users' perception about the existence of lingering oil on the beaches of the Sound.

Study Area

Prince William Sound (PWS) is located in south-central Alaska at 61^{o} N, 148^{o} W. The Chugach and Kenai Mountain ranges separate most of PWS from interior Alaska and two large islands, Montague and Hinchinbrook, shelter the hundreds of bays and islands that make up PWS from the Gulf of Alaska (Murphy et al., 2004). The maritime climate of PWS is characterized by heavy annual precipitation, much of which falls in the form of snow during long winters. Summers are generally cool and wet Lowlands are dominated by old-growth Western Hemlock (*Tsuga heterophylla*) and Sitka Spruce (*Picea sitchensis*) forests. Terrestrial vegetation begins within 1-2 m of the high-tide line. Blueberries and huckleberry (*Vaccinium sp*.), Rusty Menziesia (*Menziesia ferruginea*), Devilsclub (*Oplopanax horridum*) and salmonberries and thimbleberries (*Rubus* spp.) are common understory species found in forests and disturbed areas. The shoreline is comprised of tall, rock cliffs, gravel beaches, tidal flats, rocky outcrops and islands, estuaries and tidewater glaciers. PWS shorelines are exposed to large fluctuations in tide (+6 m to -1 m) and different levels of wave action (Bowyer et al. 1995).

Chugach National Forest (CNF) manages most of upland PWS, including the 2.1 million acre Nellie Juan Wilderness Study Area (Twardock and Monz 2000). The state of Alaska as well

as the Chugach Alaska, Chenega, Tatitlek and Eyak Alaska Native Corporations own approximately 20% of land in PWS, with another ~1% being privately-owned.

We used Analysis Areas currently used by the CNF for administration of special use permits in PWS to summarize our data, and added two additional areas of Open Water and Valdez Area Non-Forest lands. These Analysis Areas or AAs, include glaciers, steep terrain, and non-National Forest lands (Figure1). Each AA ranges in total size from 841 km^2 (Montague Island) to 30km^2 (Green Island) and contain a total of 5,600 km of shoreline They represent a product of a related and concurrent study: Prince William Sound Human Use Hot Spots GIS Database and Spatial Analysis. An additional product from that analysis is a layer of smaller spatial units called General Areas (GAs), defined as a mid-level spatial unit large enough for ease of display and small enough to capture the spatial distribution of specific landscape

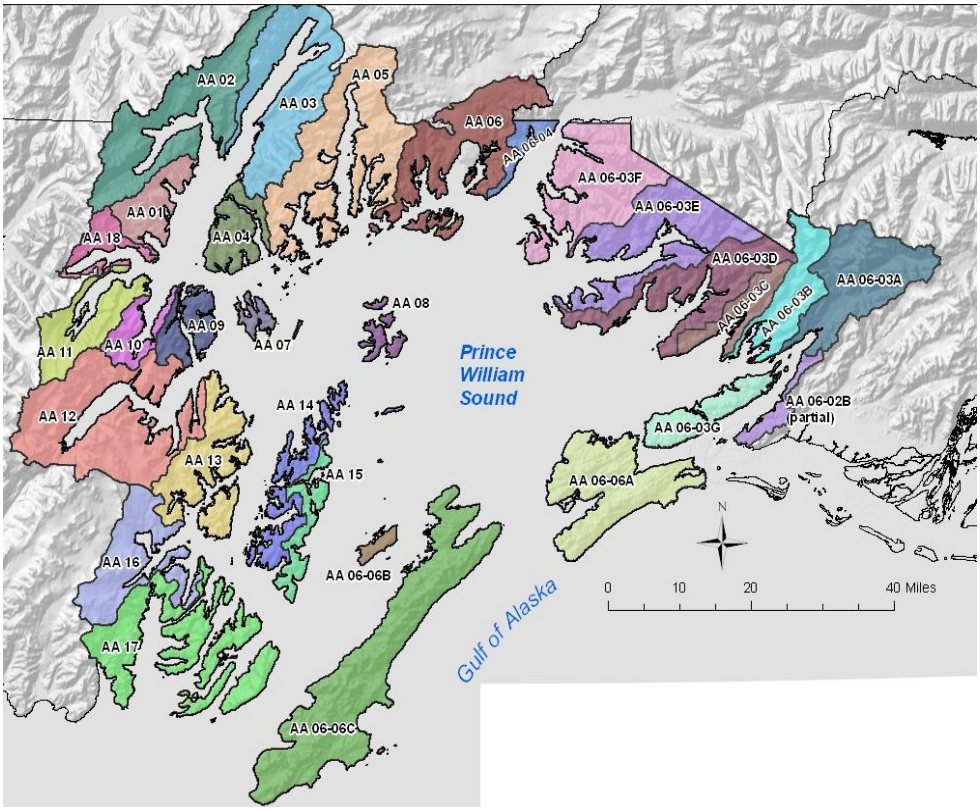


Figure 1: Analysis Areas currently used in PWS for special use permit administration. Note that the portion of AA-06-02B represented adjacent to Cordova is a small fraction of the larger area which is managed as part of the East Delta rather than PWS.

attributes including human use features. A total of 537 GAs were defined in the study area, ranging in size from 0.1 – 800 km^2 (averaging 36 km^2) with each AA being composed of varying numbers of GAs (Poe and Greenwood 2010).

Human use of Prince William Sound is strongly seasonal due to variable weather and extreme winter conditions. Recreational use of uplands (including hunting), recreational boating, and sport fishing occur mainly from May through September. Previous studies have used a recreational season of May 1 – September 30 in eastern PWS (USDA Forest Service 2008) and May 15 – September 15 in western PWS (USDA Forest Service 2005).

Four seasons were defined for the Prince William Sound Human Use Hot Spots GIS Database and Spatial Analysis project (Poe and Greenwood 2010) and are used here for consistency as well as comparison potential. They are:

- Spring = April 1 thru June 14
- Summer = June 15 thru August 31
- Fall = September 1 thru December 31
- Winter = January 1 thru March 31

The seasons listed above were defined based on a review of existing recreational use studies of PWS as well as sport hunting seasons established by Alaska Department of Fish and Game (ADF&G) for species harvested in PWS including brown bear, black bear, deer, and mountain goats (Poe and Greenwood 2010).

METHODS

The project has three principle components: Transect Surveys, Recreation User Profile Questionnaires, and Recreation Focus Groups. The methods for each are described accordingly.

Transect Surveys

In order to complete an empirical inventory of boat use across PWS, water-based transects were operated between May and September of 2007 and 2008. These transects were operated using a combination of small motorized boat and kayak based observation crews. May-early June (*Spring*) and Late August-Mid October (*Fall*) surveys were completed by motorized boat due to the need to cover vast distances in short windows of time around inclement weather patterns. *Summer* surveys (Mid June-Mid August) were completed by kayak-based crews and these observations included at least 3 daily, shore-based observations periods lasting 30 minutes in duration.

Each transect began when the observer entered the water and was ready to record observations and ended when the observer left the kayak or stopped the boat for longer than 15 minutes or during challenging water conditions when safety was a concern and observations could not be recorded at the time they occurred (e.g. during a long crossing of open water or rough seas)**.** Boats traveled within a range of 10 - 20 knots and kayaks 2-4 knots during water-based surveys. For kayaks transects occurred within ~100m of shorelines and for motorized boats within ~250m of shoreline. All observers where equipped with a survey datasheet, observation datasheet, a map and a Global Positioning Systems (GPS) for recording waypoints for each transect. Waypoints were taken for the shore-based surveys to capture the location of land visit. For both modes of transportation the total amount of time spent on each transect was recorded to allow for comparison of use density between AAs.

At least one visitor observation datasheet was used each day to record the location of encounters with boats or shore parties. A visitor observation began at the first sighting of a water or land-based visitor and ended when the visitor was no longer in sight. The following was recorded with each observation: time of detection; party location on 73,560 topographic map as well as a GPS waypoint for the observer; the vessel type *(K = kayak, TC = tour/cruise, OS = onshore user, CF = commercial fishing, OST = onshore tent, FW = fixed wing aircraft, IN = inflatable or skiff, HE = helicopter, CC = cabin cruiser S = sailboat, MY = motor yacht, OT = other (barges, oil rigs*); estimated categorical distance at first encounter and closest approach (*<100m, 101-500m, 501m-1km, >1km*); the duration

of the observation defined as the total time the vessel is visible to the observer, as well as if the vessel was moving. The locations and times of encounters with small fixed wing aircraft and helicopters were also recorded as part of this inventory process.

The locations of all vessels observed were stored in a GIS database and observations were summarized to AAs. Those vessel classes likely indicative of a recreation user (all but CF and OT) were identified as recreation groups and removed from the set for summary analysis, predictive density modeling and subsequent comparison to a GIS database of human use hotspots compiled by Poe and Greenwood (2010).

Recreation locations identified on questionnaires distributed during 2005 and summarized by Wolfe et al. (2006) as well as those locations collected by the questionnaire distribution effort described below were analyzed for spatial correlation with transect observations. This was accomplished through kernel density interpolation of mapped use points from 2005 and 2008 questionnaires in Spatial Analyst (ESRI 2009) using default settings including the search radius of 5,538 m. This process generated a continuous raster surface of 250 m cells representing the density of recreation vessels in PWS. This surface was then classified into five classes using quantile classification scheme in Spatial Analyst. The points observed on transect were then evaluated relative to class membership using a Chi-square and subsequent Pearson's Coefficient of Correlation analysis.

Subsequent kernel density interpolations were used to generate density surfaces (250 m cells using default search radii settings) from a combination of both trip diary and transect observation locations for the spring, summer and fall seasons. Using the zonal statistics tool in Spatial Analyst summary recreation vessel density values were predicted for both AAs and GAs and categorized using quantile classification into areas of High, Medium, and Low overall vessel use. This was completed for each season of use.

In an effort to explore relative groups of recreation users at one time within AAs, further evaluation of summer transect observations was completed. This was accomplished by selecting all recreation groups observed on transect (including both water and shore based observations) within each AA then dividing that number by the total hours of observation within that AA, to get a relative observations/hour measure. To allow for comparison to known numbers of permitted commercial activity[1] the observations/hour was multiplied by 12 to represent the likely number of groups using the AA within one Recreation User Day (ie., a 12-hour period). Actual density estimates for groups per km^2 of saltwater were also computed for each AA using these estimates of recreation groups at one time.

Encounter dynamics of kayak based observers were summarized for water and shore encounter separately and focused on distance of earliest detection and closest distance of approach.

Recreation User Profile Questionnaires

In order to characterize visitors to PWS, a survey tool was constructed and on-site contacts of survey targets were made by Forest Service and contract personnel. Survey distribution was focused at the three primary harbors used to access Prince William Sound: Whittier, Valdez,

[1] The CNF monitors commercial recreation outfitter and guide operations (e.g., kayak and charter boat companies) that use USFS managed uplands in the Sound under a Special Use Permit process. These permit use numbers, defined as one client per one 12 hour day on the Forest, are summarized by season and AA allowing for a relative comparison of the proportion of commercial use occurring in the Sound.

and Cordova. Efforts were stratified across weekend and weekdays. Time of day was incorporated into sampling procedures such that distribution efforts focused on peak use periods. Sampling was undertaken approximately four days per week for 6-8 hours daily from Mid-May through mid-September of 2008. Weekdays were sampled as randomized two- day blocks to ensure weekday use was captured. Both weekend days were consistently sampled throughout the survey period. Each of the surveys was coded by location (Whittier, Valdez or Cordova) with a number associated with this coding.

Researchers distributing the surveys kept track of the survey number, number in party, mode of travel and time of exit. They also kept track of refusals in an attempt to acquire a estimate of the total numbers of visitors entering the Sound from the respective locations for the sampling period. The survey instrument was enclosed in a zip lock plastic bag for protection from water. The instrument package included a return-addressed, stamped envelope and an enrollment postcard for a prize drawing (a participation incentive). Survey recipients were instructed to log the course their activities throughout the duration of their trips with an option to return completed surveys by mail or at collection sites at harbor distribution locations.

We aimed to acquire the most statistically valid and spatially and temporally representative sample possible. Prior to beginning data collection, we attempted to build awareness of and support for the project by contacting some recreation groups as well as local transporters (e.g., water and taxi services), harbor masters, and guides to seek input into the survey process and inform them about our intentions of sampling in 2008.

Concurrent with survey distribution, survey crews collected and recorded several data items from intercepted individuals. In order to determine whether those who declined to participate in the survey are statistically different from those who participated, all individuals were asked: if they were Alaska residents, primary purpose of trip (cruising, kayaking, and hunting/fishing), vessel type, and anticipated length of trip, and whether respondent agreed or refused to accept and complete a survey. This information was useful in calculating several statistics including overall response rate, and response rate by class (purpose of trip, vessel type, and Alaska residency).

Questionnaire responses were entered into a tabular database and responses were tallied for the individual questions posed using a combination of ranks and summary proportions of response. Individual locations of recorded use mapped on the associated trip diary were digitized into GIS and summarized at the spatial resolution of AAs.

In order to explore temporal and spatial distribution of respondents we used Recreation Behavior Simulator (RBSim), a software program fully integrated with ArcMap that has been specifically developed by researchers from GeoDimensions Pty Ltd and the University of Arizona for studying patterns of recreation use (e.g., Gimblett *et al.* 2001, Gimblett 2002, Itami 2003). RBSim was been used in the Sound previously by Gimblett and Itami (2006) to develop a simulation model for the Sound using data from the Wolfe et al. (2006) to replicate the data collected on visitor use.

A trace-simulation was developed from the trip diaries and survey responses to evaluate the distribution of use across the Sound by mode of travel, analyze popular destinations, evaluate how long visitors spend at these sites and who they encounter both on water and on land. A series of simulations of existing peak use and forecast future use levels in the Sound were undertaken. The simulation was replicated 100 times to acquire a more accurate

representation of distribution of visitor use. For each simulation replication, the following behavior variables are randomized:

- Selection of trip itineraries – a trip is randomly drawn from a pool of trips with the same port and the same day of week.
- Launch times are randomized based on ranges from questionnaire data
- Travel speeds are randomized around a mean for each vessel type (Gimblett and Itami 2006)
- Departure times from destinations are randomized within the time frame of 1 hour.

Simulation outputs were then averaged over the 100 replications. Since many trips are multiple day trips, it was necessary to run the simulation a sufficient time in order to fully populate the simulation before outputs are calculated. In this simulation the first two weeks of June were used as the test period and were discarded before simulation outputs are calculated on the remaining simulation days. The outputs of the simulations provided a spatial view of the changes in visitor densities and volumes at peak use levels by day of the week and by port of departure. Outputs were reported to the AA level by vessel class. Potential recreation use futures over the next 10 years using a theoretical 1.5% per year growth regime were also explored using this trace simulation.

Limits of Sustainable Activity Focus Groups

The Level of Sustainable Activity (LSA) concept is a generalization of the Level of Service concept developed by the Transportation Research Board (2000). In this study we implement the LSA framework to explicitly evaluate the relationship between quality of experience and varying levels of density of user types from the perspective of local focus groups composed of individuals with long experience recreating in the Sound. We specifically used LSA to explore:

- quality of experience objectives and criteria for three different user groups
- visitor capacity levels within and between user groups
- suggestions from users for attaining or maintaining quality of experience objectives

Recreational capacity is different for each user group and varies in relation to distance from nearest port, coastline geometry, the provision of facilities, and the interaction with other users. As such quality of experience was explored using as comprehensive of a framework as possible, integrating relevant factors but maintaining a relatively simplistic format that facilitates user comprehension and participation. We selected bays or fjords with use levels defined for each vessel type ranging from low (Unakwik) to high (Blackstone Bay) use using data collected by Wolfe et al. (2006). A premise of our investigation was that areas with low levels of use likely had minimal social interactions, whereas areas with high use levels likely had high levels of user interaction and potentially higher levels of social impacts.

LSA analysis allowed us to look at use levels as they related to:

- Physical characteristics of the environmental setting, including navigable depth, and shoreline sinuosity characteristics
- Physical characteristics of different vessel types, including their size, speed, noise and passenger capacity
- User attitudes toward competing traffic safety, environmental and social risk factors relating to increasing use densities
- Suggestions from users on management options for dealing with the above risks

LSA workshop participants

LSA workshops were conducted in three communities around Prince William Sound:

- Cordova is a remote, small community with a population of 2,242 (in 2008), accessible only by boat (including a ferry service) or plane
- Valdez is a small remote community with a population of 3,787 (in 2008), accessible by boat, road and plane.
- Anchorage is Alaska's largest city with a population of 279,243 (in 2008) it is well serviced by all transportation modes and is the source of most boat traffic into Prince William Sound.

Within these three communities, members of each of the three recreational user groups were selected for participation in separate workshops for each group for a total of nine workshops. The three user groups were: (1) kayakers; (2) recreational motor and sail boaters, and (3) hunters. In addition, to pre-test the workshop format, USFS managers and staff from Cordova and Anchorage participated in a workshop representing themselves as recreational boaters.

Figure 2: Location map for Blackstone Bay, Unakwik Inlet and Sheep and Simpson Bays – (Source: Microsoft Bing Maps 2009)

Scenario Areas

Figure 2 shows the location of the three scenario areas for the LSA workshops. Blackstone Bay is on the east side of PWS. Unakwik Inlet is north central and Sheep and Simpson Bays are north of Cordova. These three locations were selected for their geographic distribution, differences in size and shoreline configuration, level of use and relative distances to the ports of Cordova, Valdez and Whittier. The rationale for selection is to determine if these factors affect local perceptions of quality of service. Blackstone Bay (Figure 3) is in the west side of PWS and is the closest of the three areas to Whittier, which is the port of departure into the Sound for the vast majority of Anchorage residents. It therefore is closest to the largest urban

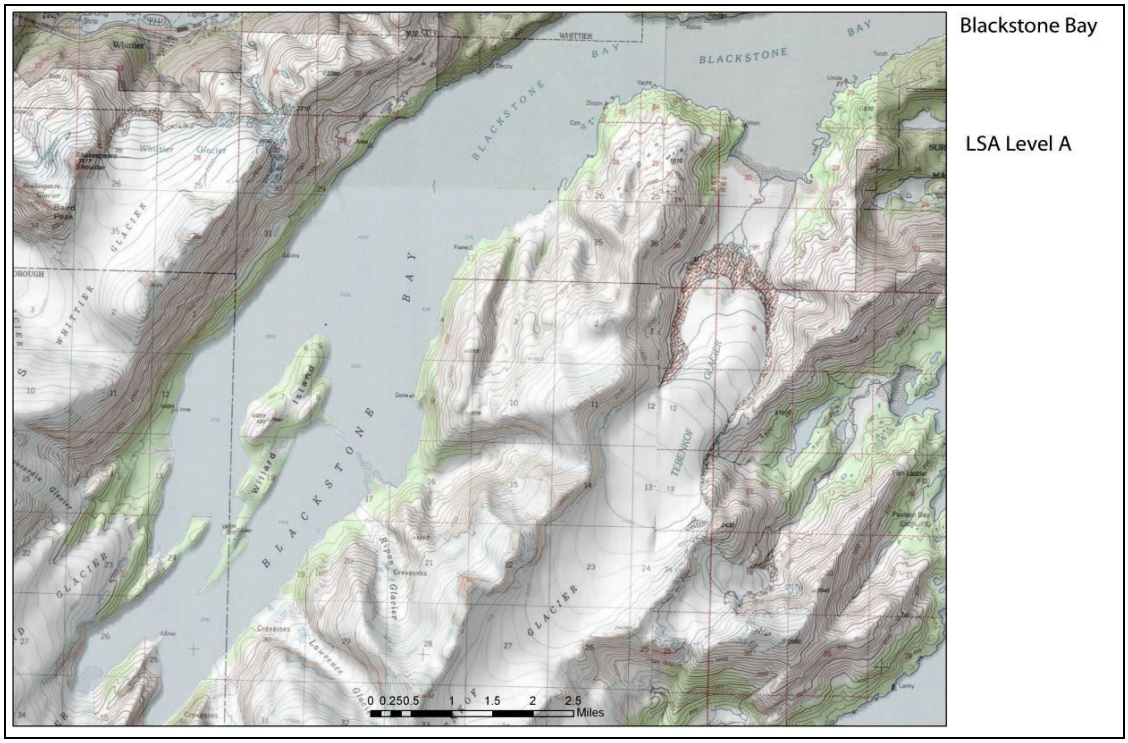


Figure 3: Blackstone Bay in western Prince William Sound an area of relatively high recreation use.

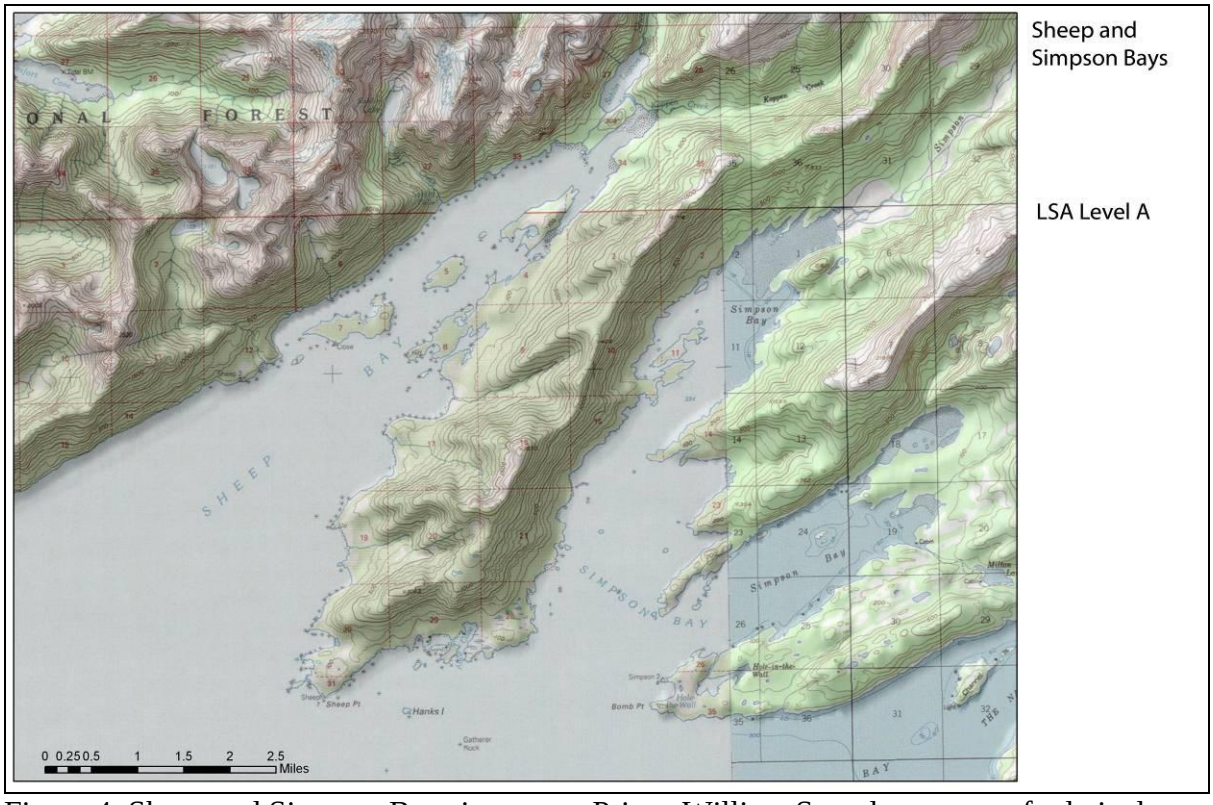


Figure 4: Sheep and Simpson Bays in eastern Prince William Sound are areas of relatively medium levels of recreation use.

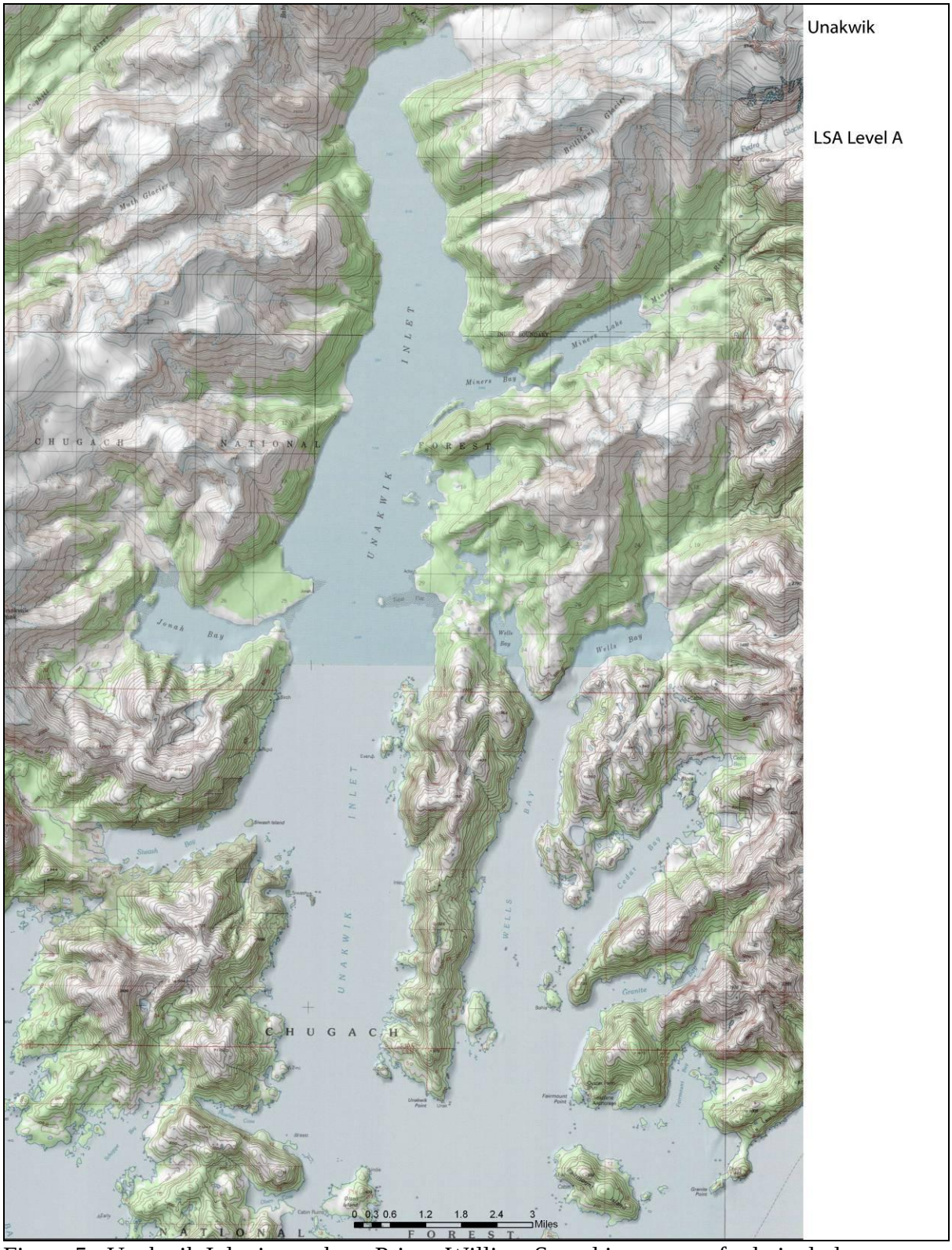


Figure 5 : Unakwik Inlet in northern Prince William Sound is an area of relatively low recreation use.

population and consequently has heavier recreational use than the other two scenario areas in this study. Blackstone Bay is 64.1 sq km^2. Sheep and Simpson Bays (Figure 4) are just north of Cordova and therefore receive some amount of use from that community; though certainly less than Blackstone Bay. Together they are 64 sq km^2 in size and contain small islands and

coves. Unakwik Inlet (Figure 5) is 109.9 sq km^2 and is the largest of the three scenario areas with a distance of approximately 30 km from the north end of the Inlet to the mouth. It is the farthest from a departure port in the Sound and therefore has the lowest density of recreation use. It also has the most diverse shoreline with four smaller bays along the perimeter.

An important aspect of managing quality of experience in outdoor environments is determining the relationship between use levels and quality of experience. A standard measure of use levels is density or the number of people, or in this case vessels or parties per square kilometer. In the LSA approach 5 levels are designated from Level A (no use) to Level E (a very high theoretical use level). These levels must be defined in the context of the level of traffic and environment under study.

For example it would be inappropriate to use the same density levels for an urbanized bay as for Prince William Sound since the essential experience in PWS is wilderness. To determine realistic LSA levels for the Sound, user survey data from 2005 were used (Wolfe et al. 2008). Daily use levels for kayaks, small motorized boats (<30 feet) and large motorized yachts and sail boats were examined for peak summer days for Blackstone Bay, Unakwik Inlet and Sheep and Simpson Bays.

Table 1 shows the density of vessels for each of the three scenario areas expressed in terms of the number of vessels per scenario area for each LSA level and the equivalent density in vessels per square kilometer. Note that the density for each LSA level is the same across all three areas for these scenario evaluations. Levels B, C, D were actual estimated density values from analysis of Wolfe's data (2008) for Unakwik Inlet, Sheep and Simpson Bay and Blackstone Bay respectively, while E was a geometric progression with density doubling and A being a theoretical scenario with no other use. Images were prepared for each scenario area with vessels denoted by points in the appropriate numbers of vessels for LSA Level A-E. Actual placement of points indicative of vessel locations generally followed actual use locations from Wolfe's 2008 dataset. (See Appendix 1 for the images generated for LSA Levels B through E for each of the three scenario areas).

Table 1: LSA Density levels for three scenario areas in Prince William Sound.

LSA Levels for Three Scenario Areas		
Sheep and Simpson Bays	**68.478 sq km**	
LSA Level	Number of Vessels	Vessels/sq km
A	0	0.00
B	2.1	0.03
C	4.2	0.06
D	8.5	0.12
E	17	0.25
Unakwik Inlet	**109.94 sq km**	
LSA Level	Number of Vessels	Vessels/sq km
A	0	0.00
B	3.4	0.03
C	6.8	0.06
D	13.6	0.12

E	27.3	0.25
Blackstone Bay	**64.16 sq km**	
LSA Level	Number of Vessels	Vessels/sq km
A	0	0.00
B	2	0.03
C	4	0.06
D	8	0.12
E	16	0.25

In order to encourage focus group members to reflect upon what makes for a good recreation experience, each member was to offer up *quality of experience objectives*. These objectives are conceptualized as the expressed reasons why people pursue outdoor recreation and the factors that contribute to or detract from these experiences. Each individual in each group was asked to freely express their quality of experience criteria by answering the following questions:

1. What experience are you looking for?
2. What are the key factors that you look for to attain this experience?

Next, participants were asked to evaluate five LSA density levels for three locations for varying density levels of three different types of vessels: kayaks, small motorized boats (<30'), large motorized yachts (>30') and sailboats. For each vessel class and each location we asked participants in all user groups to make evaluations in three different contexts:

- Preferred or *Ideal LSA*: what they would hope to encounter
- Expected LSA at busy times: what they would expect to encounter during the busy summer period
- *Maximum Tolerable LSA*: what they would tolerate before choosing not to return to that area

They were first asked to make the above evaluations for their own user group (in this case hunters were primarily small recreational boaters) and then asked to repeat the evaluations for each of the remaining two other different vessel types for a total of nine evaluations. Workshop participants were instructed not to consider commercial traffic such as fishing fleets or commercial tour boats and ferries. Individual evaluations were recorded (see Appendix 3 Raw scores for LSA ratings in community workshops) and summarized by taking the median score for each group. After making these evaluations each user group was asked the following open-ended questions around their individual experiences in the Sound:

- What are the impacts of other (types) of users on your experience?
- What suggestions do you have for management to help you attain your desired experience?
- Are there issues such as safety, noise, environmental impacts, or annoying behaviour of other users that we haven't discussed?

RESULTS

Transect Surveys

A total of 108 days worth of sampling was accomplished between 6/28/2007 and 10/4/2008. Multiple crews of observers logged over 1,600 hours of combined transect and shore observations during these 2 years of sampling (Table 3).

Table 2: Sampling dates for boat and kayak-based observations in Prince William Sound

Sampling Method	Start Date	End Date	Sample Days[2]	Sample Hours
Motorized Boat				
2008 Observations (Spring)	5/4/2008	6/15/2008	24	158
2008 Observations (Fall)	8/21/2008	10/4/2008	22	114
Kayak				
2007-2008 Observations (Summer)	6/28/2007	8/10/2008	62	1358
		Total:	**108**	**1630**

Observers based in motorized boats were able to accomplish multiple surveys of AAs within PWS for a total of 4,172 km of transects and 4,205 km during spring and summer respectively. Kayak-based observers conducted one-time inventories of AAs accomplishing a total of 2,923 km of transects during summer and in addition were able to complete 332 fixed point shore observations. Spring and Fall inventory efforts (via motorized boat) covered approximately 75% (4,200 km) of shoreline of the study area; Summer efforts (via kayak) inventoried approximately half of the study area shoreline (2,600 km). Sample effort occurred within all 31 AAs as well as a substantial portion of open-water areas of PWS.

A total of 2,868 observations of recreation, commercial fish and aircraft groups were identified and mapped to individual AAs during all seasons of sampling combined. The overall relative composition of encounter type from least to greatest was: Aircraft (7%), Commercial Fishing (40%) and Recreation Groups (53%). Substantial seasonal variation occurs in the relative proportion of these three classes of users. These proportions as well as total numbers of groups encountered are described in Table 3. Within these broad categories, the relative proportions of specific vessel/user types encountered also varied seasonally. Throughout all seasons *recreation* groups were the most common type encountered and within that class the specific type of *cabin cruiser* was the most common (Table 4).

Table 3: The relative seasonal compositions of vessel/group encounters during transect surveys in Prince William Sound.

Season	Aircraft	Commercial Fish	Recreation	Total
Spring	9	115	377	501
%	2%	23%	75%	
Summer (water)	134	463	700	1297
%	10%	36%	54%	
Summer (shore)	48	366	199	613
%	8%	60%	32%	
Fall	8	193	256	457
%	2%	42%	56%	

[2] These days represent calendar days upon which 1-3 crews may have been making simultaneous observations.

Total	199	1137	1532	2868
%	7%	40%	53%	

Table 4: Specific types of vessels/groups encountered during transect surveys in Prince William Sound.

Vessel Type	Spring	%	Summer	%	Fall	%	Total
Cabin Cruiser	242	41%	634	34%	151	34%	1027
Commercial Fishing	161	27%	618	34%	184	41%	963
Fixed-wing aircraft	7	1%	158	9%	7	2%	172
Helicopter	1	0%	10	1%	1	0%	12
Skiff or inflatable	48	8%	101	5%	15	3%	164
Kayak	6	1%	25	1%	5	1%	36
Motor Yacht	47	8%	75	4%	34	8%	156
Onshore user	14	2%	25	1%	4	1%	43
Onshore tent	17	3%	27	1%	1	0%	45
Sailboat	14	2%	41	2%	18	4%	73
Tour Cruiser/Cruise Ship	29	5%	124	7%	24	5%	177
Total	586		1838		444		2868

Further investigation of the seasonal variation in use reported for only those recreation groups with the potential to use uplands shows that cabin cruisers are consistently the most often encounter vessel type followed by motor yacht. Perhaps somewhat surprisingly kayak groups represented a small overall portion of the use in PWS though this may be due in part to detectability of smaller boats without a motorized noise signature. Table 5 describes the seasonal breakdown of use for these seven user types.

Table 5: Seasonal composition of recreation user groups with the capability of using uplands in Prince William Sound.

Vessel Type	Spring	Summer	Fall
Cabin Cruiser	62%	68%	66%
Skiff or inflatable	12%	11%	7%
Kayak	2%	3%	2%
Motor Yacht	12%	8%	15%
Onshore user	4%	3%	2%
Onshore tent	4%	3%	0%
Sailboat	4%	4%	8%

Numbers of encounters with only *recreation* parties varied widely by location (AA) within the Sound ranging from 0 in Hinchinbrook Island to 13.5/hour in Culross Passage during the summer. Observers on motorized boats encountered more individuals per hour due the a faster rate of speed on transects (3.1 +/- 3.3 during spring and 2.4 +/- 3.6 detections/hour during fall) with high rates of variance of detection rates between AAs. Summer surveys on transect via kayak (excluding shore-based observations from fixed points) returned lower rates of detection, 1.0 +/- 1.0 detections/hour yet substantially more total detections. When

controlling for the ~10 fold increase in survey speed of boat-based observers vs. kayak-based observers (ergo, the three-fold increase in days of sample effort), summer months support approximately three times the amount of total recreation traffic.

Two correlation analyses were completed using this transect data. The first evaluated the spatial relationship between 977 summer time recreation vessel observations to a classified predictive, raster surface generated from 3703 trip diary locations collected in 2005 and 2008. Based on a 5-class membership identity analysis we found a strong positive relationship (r = 0.77) between the distribution of trip diary locations and observations compiled from kayak and shore-based surveys. Based on this strong positive relationship between diary and transect locations predictive surfaces were generated using combined vessel observation points from transect with diary locations from within the same season. The class membership of transect observations relative to predicted density class, 1 being highest and 5 being lowest, is presented in Table 6.

Table 6. Class membership for recreation vessel observations during summer months relative to predictive density interpolation class from trip diary locations in Prince William Sound.

Predicted Density Class	# Transect points
1	269
2	450
3	124
4	78
5	56
Grand Total	977
Pearson's r = 0.77	

Based on these results three raster surfaces were generated for spring, summer and fall from 1,583, 4,680, and 483 input points, respectively. These raster surfaces in NAD83 projection are available for download at the project website: http://tinyurl.com/33y994q. Summary predictions of recreation use during the peak summer season for recreation activity (High, Medium, Low) were generated for AAs and GAs. These results for AAs are presented in Table 7 alongside relative intensities of commercial operations permitted by the CNF under Special Use Permit from 2005-2007 (unpublished FS data).

Table 7: Relative densities of recreation vessels compared to permitted commercial recreation managed by the Chugach National Forest during summer in Prince William Sound.

Analysis Area	Summer Vessel Density	Special Use Permit
Blackstone Bay AA11	High	High
Cochrane Bay AA10	High	Low
College Fjord AA03	Low	Medium
Columbia Bay AA06	Medium	High
Culross Island/Passage AA09	High	High
Eaglek/Unakwik AA05	Medium	High
East Knight Island AA15	Medium	Low
East Valdez Arm 06-03F	High	None
Esther Island/Passage AA04	Medium	Medium
Fidalgo Bay 06-03E	Low	None

Gravina Bay 06-03D	Low	Low
Green Island 06-06B	Low	Low
Harriman Fjord/BarryArm AA02	Medium	High
Hawkins Island 06-03G	Medium	Low
Hinchinbrook Island 06-06A	Low	Low
Icy/Whale Bay AA16	Low	High
Kings Bay/Port Nellie Juan AA12	Medium	Medium
Montague Island 06-06C	Low	Low
Naked Island Group AA08	Medium	Low
Nelson Bay 06-03A	Low	None
OpenWater	Low	None
Passage Canal AA18	High	High
Perry Island AA07	High	Medium
Port Bainbridge AA17	Low	Medium
Sheep Bay 06-03C	Low	None
Simpson Bay 06-03B	Medium	Low
Valdez Area Non-Forest	High	High
West Delta 06-02B	Medium	None
West Knight Island AA14	Medium	Medium
West Knight Island Passage AA13	High	Medium
West Port Wells AA01	High	Medium
West Valdez Arm 06-04	High	Medium

The second correlation analysis evaluated four classes of total predicted human use (including both commercial fishing and recreation vessels as well as onshore recreationists) during summer months reported by the Human Use Hotspots analysis (Poe and Greenwood 2010) within 350 saltwater GAs for the summer season. When summer density predictions for all vessel classes combined were similarly classified into four classes and summarized to the GA level, they returned a correlation value of $r = 0.72$ with Hotspot predictions of overall use. These two correlation findings suggests that when evaluated in generalities at the 4 or 5 class level, our transect data corroborates similar predictions of use documented by Wolfe et al. (2006) as well as Poe and Greenwood (2010).

A further exploration of use density during the summer season allowed us to predict user groups at one time within AAs for subsequent comparison to reported use from commercial outfitter and guides permitted by the CNF from 2005-2007 (unpublished Forest data). Commercial use permitted by the CNF was overall a small proportion of total use occurring within each AA, typically being <10%. Commercial use accounted for a total percentage in the double digits in only a few AAs including HarrimanFjord/Barry Arm as well as Icy/Whale Bay and Columbia Bay. A few areas like Port Fidalgo, Nelson Bay and Sheep Bay host no summer time commercial use. The distribution of total groups per day, overall density of use and relative proportions of commercial use by AA during summer months is compiled in Table 8.

Table 8: Estimated groups per day, density of overall use, and percent commercial occurring within Analysis Areas during summer months in Prince William Sound.

Analysis Area (AA)	Total Groups/day	Groups/km^2	Commercial groups	% Commercial
Blackstone Bay	25.53	0.35	1.34	5.24
Cochrane Bay	17.07	0.28	0.06	0.36
College Fjord	6.57	0.04	0.11	1.63
Columbia Bay	8.62	0.06	1.43	16.58
Culross Island/Passage	41.61	0.97	0.69	1.67
Eaglek/Unakwik	6.86	0.03	1.02	14.82
East Knight Island	5.35	0.14	0.10	1.80
East Valdez Arm	18.06	0.25	0.01	0.06
Esther Island/Passage	11.61	0.20	0.36	3.11
Fidalgo Bay	3.80	0.02	0.00	0.00
Gravina Bay	2.97	0.02	0.06	1.91
Green Island	5.71	1.12	0.03	0.49
Harriman Fjord/BarryArm	7.58	0.07	1.50	19.84
Hawkins Island	11.48	0.08	0.06	0.49
Hinchinbrook Island	3.63	0.01	0.02	0.62
Icy/Whale Bay	4.03	0.05	0.68	16.82
Kings Bay/Port Nellie Juan	7.53	0.03	0.46	6.07
Montague Island	2.64	0.02	0.02	0.64
Naked Island Group	7.05	0.14	0.02	0.24
Nelson Bay	0.00	0.00	0.00	0.00
Passage Canal	51.73	0.74	0.67	1.30
Perry Island	7.91	0.41	0.23	2.86
Port Bainbridge	4.15	0.01	0.16	3.94
Sheep Bay	4.03	0.09	0.00	0.00
Simpson Bay	2.73	0.10	0.02	0.62
Valdez Area Non-Forest	35.53	0.14	0.00	0.00
West Knight Island	3.70	0.03	0.50	13.58
West Knight Island Passage	18.70	0.17	0.50	2.66
West Port Wells AA01	11.00	0.29	0.32	2.93
West Valdez Arm 06-04	26.94	2.72	0.00	0.00

Results from encounter dynamics experienced by our observers relative to detection distance and proximity of approach was summarized for 2007 and 2008 transect observations. The vast majority of other parties (97%) were detected when those parties were on the water. Approximately 90% of detections were made when the other party was underway. The majority of detections of any other party happened at distances >1000 m across all three types of sampling: shore-based (68%), kayak-based (80%) and boat-based (70%). These percentages decrease slightly when considering only those encounters with other recreation parties but still the majority (66-73% depending on observer type) occur at distances >1000

m. A similar pattern was found when evaluating the closest distance of approach with 61% and 65% staying >1000 m away from shore and kayak-based parties respectively. A different pattern emerged for boat-based observers in which 38% of groups stayed >1000 with 18% coming within 100m. This is likely do the fact that encounters of other boats were the most frequent type and boat-based observers were likely using similar travel routes farther out from shore when compared to kayak and shore-based observers. Tables 9-11 describe the detections relative to distance of first detection and closest approach by observer type.

Table 9: Distance at detection and distance of closest approach for encounters during transect sampling efforts of boat-based observers in Prince William Sound.

DISTANCE DETECTED (m)		CLOSEST APPROACH (m)	
Boat-based observations			
All Observations n = 1019			
100	2%	100	18%
300	2%	300	8%
500	10%	500	19%
1000	17%	1000	17%
>1000	70%	>1000	38%
		42% got closer	
Recreation Groups Only n = 655			
100	3%	100	24%
300	2%	300	6%
500	11%	500	20%
1000	18%	1000	15%
>1000	66%	>1000	34%
		35% got closer	

Table 10: Distance at detection and distance of closest approach for encounters during transect sampling efforts of kayak-based observers in Prince William Sound.

DISTANCE DETECTED (m)		CLOSEST APPROACH (m)	
Kayak-based observations			
All Observations n = 947			
100	3%	100	10%
300	3%	300	6%
500	5%	500	9%
1000	9%	1000	9%
>1000	80%	>1000	65%
		26% got closer	
Recreation Groups n = 511			
100	6%	100	15%
300	4%	300	7%
500	6%	500	11%
1000	11%	1000	11%
>1000	73%	>1000	56%
		32% got closer	

Table 11: Distance at detection and distance of closest approach for encounters during transect sampling efforts of shore-based observers in Prince William Sound.

DISTANCE DETECTED (m)		CLOSEST APPROACH (m)	
Shore-based Observations			
All Observations n = 451			
100	2%	100	6%
300	3%	300	7%
500	10%	500	11%
1000	12%	1000	14%
>1000	72%	>1000	61%
		19% got closer	
Recreation Groups n = 254			
100	3%	100	8%
300	2%	300	6%
500	14%	500	16%
1000	13%	1000	15%
>1000	68%	>1000	55%
		37% got closer	

Recreation User Profile Questionnaires

The following section reports the results from the questionnaire survey. Responses are summarized primarily in tabular format and results are reported relative to the number of respondents who chose to answer each question. Tabular items presented I bold within each table represent notable findings relative to individual questions. The later section condenses the survey respondents into three groups; boaters, kayakers and Yacht/Sailboats. Table 12 describes the sampling process for the survey. A total of n=1,377 surveys were distributed and a total return of n=341 given the research team an overall 25% return rate. The sampling response rates at each of the three remote locations were similar, suggesting that a statistically representative sample of visitors was obtained.

Table 12: Survey response rate by harbor of departure for Prince William Sound recreationists.

Survey Location	Total Accepted	Total Refused	Total Returned	Response Rate
Whittier	667	56	176	26%
Cordova	95	55	25	26%
Valdez	615	114	140	23%
			Average:	25%

Have you seen any evidence of lingering oil from the Exxon Valdez Oil Spill?

An initial question that relates closely to the state of the recovery of the Sound from the Exxon Valdez Oil Spill was whether there was any evidence of lingering oil. Of the 172 respondents that answered this question, 99% indicated that they did not see any lingering oil while only two (1%) suggested that they did see some oil. Overwhelmingly, respondents agree that they did not see any evidence.

How many are in your party?
Respondents sampled typically travel in 1-2 or 3-4 per group.

Table 13: Number of people in party for Prince William Sound recreationists.

Number in Party	Total Count
1-2	121
3-4	127
5-6	42
7-10	20
11-15	7
32	1

What are the typical numbers of days you spend in PWS?
Over 45% of the respondents indicated that 2-3 days were the typical number of days that they spent in the Sound. Notable in Table xx is that nearly 23% only use the Sound for a day, and a significant portion of these visitors indicated that their main recreational activity was fishing.

Table 14: Number of days spent by for Prince William Sound recreationists.

Days Spent on Trip	Total Number	Percent of Respondents
1 day	79	23%
2-3 days	157	46%
4-5 days	56	16%
6+ days	51	15%

How frequently do you visit PWS?
When asked how frequently the respondents entered the Sound, nearly 70% go in more than two times per year and of these 98% were Alaska residents.

Table 15: Frequency of use for Prince William Sound recreationists.

Frequency of Using PWS	Total	Response Rate
Two or more times a year	234	68%
Never before	47	14%
Once a year	36	11%
Once every few years	25	7%

What are the primary modes of travel in PWS?
When asked about their primary mode of travel entering the Sound, over 65% responded that they are in small motorized boats, 15% in kayak and nearly 12% in Motor Yachts.

Table 16: Primary mode of travel for Prince William Sound recreationists.

Mode of Travel	Total Number	Response Rate
Float plane/helicopter	2	<1%
Inflatable	4	1%
Kayak	49	**14%**
Motor yacht	41	**12%**
Sailboat	11	3%
Smaller motorized boat	223	**65%**

Tour boat	11	3%
Other	2	<1%

What is the proportion of modes of travel by port of entry?
In this study it was really important to understand which of the modes of travel were more dominant in which of the ports of entry sampled. Smaller motorized boats were evenly distributed between the three ports. Kayaks were most dominant out of Whittier followed by Cordova.
Table 16: Port of entry and mode of travel for Prince William Sound recreationists.

Location	Inflatable	Kayak	Motor yacht	Sailboat	Smaller motorized boat	Tour boat
Cordova	0%	17%	8%	0%	**75%**	0%
Valdez	2%	6%	17%	1%	**68%**	6%
Whittier	2%	21%	9%	3%	**63%**	2%

What are the primary recreational activities in PWS?
Primary or most desired recreational activity in the Sound is fishing 54%, followed by kayaking 13%, sightseeing 11% and general boating 8%.

Table 17: Primary activity of Prince William Sound recreationists.

Primary Reported Activity	Total Count	Response Rate
Fishing	184	**54%**
Kayaking	45	**13%**
Sightseeing	37	**11%**
General boating	27	8%
Overnight mooring/anchorage	7	2%
Hunting	5	1%
Overnight stay in cabin	5	1%
Subsistence Fishing	5	1%
Wildlife Viewing	5	1%
Primitive camping	4	1%
Hiking/backpacking	2	<1%
Picnicking/family/berry picking	1	<1%
Subsistence hunting	1	<1%
No Response	15	4%

What are the prime destinations that you tend to be attracted to in PWS?
Understanding the prime destinations that are sought is very important to long term management of the Sound. Blackstone Bay, Port Valdez, Jack Bay, Culross Passage and Knight Island top the list.

Table 18: The top 10n planned ultimate destinations of for Prince William Sound recreationists.

Planned Ultimate Destination	Total Count	Response Rate
Blackstone Bay	17	7%
Port Valdez	12	5%
Jack Bay	11	4%
Culross Passage	9	4%
Knight Island	7	3%
Montague Island	7	3%
Bligh Island	6	2%
Harriman Fjord	6	2%
Naked Island	6	2%
Simpson Bay	6	2%

What are the reasons for selecting these destinations?
Good fishing opportunities, glacier viewing and wildlife viewing were the top motivations for selecting preferred destinations.

Table 19: Reasons Prince William Sound recreationist selected ultimate destinations.

Reasons for Selecting Destination	Total	Response Rate
Good fishing	91	**40%**
Glacier Viewing	48	**21%**
Wildlife Viewing	43	**19%**
Solitude	21	9%
Proximity to Whitter	9	4%
Kayaking	8	4%
Proximity to Anchorage	6	3%

What are the reasons why you are displaced?
Over 88% of respondents indicated that they were not displaced from preferred destinations; of those who were displaced, weather was the primary cause. No respondents reported being displaced based on encounters with others.

If these sites are crowded what do you typically do?
Encounter levels and crowding were not found to be significant issues impacting respondents' recreation experience. However, when asked what they would do *if* they felt crowded, over 86% suggested that they would relocate to another location. When asked about site qualities they would look for if they did move to another location, respondents indicated they would look first for another place in reasonable travel distance and second for sites with similar qualities, and to a lesser degree would simply look for the next available location.

Table 20: Typical response to *theoretical* feelings of crowding offered by Prince William Sound recreationists.

When Crowded What do you do?	Total	Response Rate
Do Nothing and stay in Location	44	14%
Relocate to Another Location	274	86%
Leave and Return to Point of Origin	0	0%
Other	1	<1%

Are respondents satisfied with their trips?
Trip satisfaction can be an indicator of how well respondents enjoyed their trip to the Sound. Overall respondents were extremely satisfied with their experiences with 89% of the respondents indicated that trip satisfaction was as they expected, much better or more then they expected. For those whose overall satisfaction was less or much less than expected, the main reasons given were crowding at the dock in Whittier or poor weather conditions.

Table 21: Overall trip satisfaction of Prince William Sound recreationists.

Overall Trip Satisfaction	Total #	Response Rate
More than Expected	137	**40%**
Much Better than Expected	93	**27%**
As Expected	76	**22%**
Less than Expected	15	4%
Much less than Expected	5	1%
No Response	17	5%

Alaskan Resident levels of Satisfaction with their Experiences?
Satisfaction levels were overall very high with over 90% rating trip satisfaction as they expected, much better or more than they expected. This finding varied only slightly between ports of departure.

Table 22: Satisfaction levels by port of entry for Alaskan residents

	Much Better than Expected	More than Expected	As Expected	Less than Expected	Much Less than Expected	No Response
Cordova	**48%**	26%	17%	9%	0%	0%
Valdez	**39%**	28%	24%	5%	4%	0%
Whittier	**45%**	28%	23%	4%	0%	0%

Out of state visitor levels of Satisfaction with their Experiences?
Out of State visitors' levels of satisfaction were similar to those of Alaska residents but varied much more by port of departure. While almost 100% indicated that their experiences out of Whittier were was as they expected, much better or more than they expected there was a significant portion out of Cordova and to a lesser degree in Valdez that indicated that satisfaction was less then expected.

Table 23: Satisfaction levels by port of entry for Prince William Sound recreationists.

	More than Expected	Much better than Expected	As Expected	Less Than Expected	Much less Than Expected
Cordova	33%	33%	17%	0%	**17%**
Valdez	43%	40%	10%	3%	3%
Whittier	50%	41%	8%	0%	0%

What are the differences in experience/satisfaction levels between participants in consumptive (hunting and fishing) vs. non-consumptive activities?
Those engaging in fishing or hunting activities were slightly less satisfied with their experiences then those in other activities. Over 25% indicated that their experiences were as expected with 9% less then expected. Generally participants in non-consumptive activities were more satisfied with their experiences.

Table 24: Satisfaction levels between consumptive and non-consumptive Prince William Sound recreationists.

	Much Better than Expected	More than Expected	As Expected	Less than expected	Much Less than Expected
Fishing/Hunting	41%	25%	25%	7%	2%
Other Activities	45%	33%	21%	2%	0%

Are you likely to visit Prince William Sound again?
An overwhelming 95% of respondents stated that they would visit the Sound again.

Were you adversely impacted by encounters with other users?
Encounter levels are frequently an indicator of dissatisfaction with experience opportunities or displacement from an area. The majority of respondents (62%) chose not to answer this question. Of those that did respond, 85% suggested that encounters with other users will not affect their decision to visit the area in the future.

Table 25: Adversely Impacted by Encounters with Other Users

Adverse Impacts due to Encounters with Others	Total	Response Rate
Will not affect my future decisions to Visit	111	85%
Next time I will visit when less likely to encounter others	19	15%
I will no longer visit this area within PWS.	1	<1%

If so, with whom are you having these negative encounters?
Out of a total of n=343 respondents, only n=31 responded when asked with whom they had negative encounters. While not statistically significant, noise from ships and planes were identified as having the most impact on those who responded followed by commercial boats and conditions at the Whittier docks. It should be noted that these numbers are not statistically significant but provide some anecdotal information in understanding negative encounters.

Table 26: Reasons for negative encounters experienced by 31 (out of 343 total respondents) Prince William Sound recreationists.

Reasons for Negative Encounters	Total	Response Rate
Noise (Ships and Planes)	12	38%
Commercial Boats	7	23%
Whittier Boat Ramp Crowded	6	19%
Crowded	4	13%
High Speed Ferry	2	6%
Total Respondents	31	

What are the Experiences Respondents are seeking in PWS?
Experience opportunities are an important reason why respondents visit the Sound each year. Table 27 summarizes those experiences in terms of percent rankings. Enjoying the natural beauty, spending time with family and friends, fishing and being in a wild undeveloped place are very important reasons why respondents indicated they came to the Sound. Hunting was not as highly ranked as was originally thought. However a closer examination of the respondent pool suggests that we did not capture the season for which we may have seen more hunters in the Sound. The sampling period ended before a majority of the hunting activity started which is biasing the sample.

Table 27: Relative importance of recreation experiences sought by for Prince William Sound recreationists.

Experienced Opportunity	Not Important 1	2	3	4	Very Important 5
Enjoy Natural Beauty	1%	2%	5%	22%	**71%**
Spend time w/Family & Friends	6%	2%	10%	22%	**60%**
Fishing	15%	4%	12%	17%	**51%**
Be in wild/undeveloped place	5%	6%	15%	25%	**49%**
Observe Wildlife	1%	6%	26%	30%	37%
Experience Solitude	4%	7%	23%	29%	37%
Experience Something New	14%	9%	23%	23%	31%
Experience Challenge and Adventure	13%	10%	27%	23%	26%
Hunt	79%	5%	6%	3%	6%
See Cultural Sites	52%	21%	18%	5%	5%

Were you able to obtain those experiences while visiting PWS?
Table 28 was constructed to provide a summary of whether respondents were able to obtain the desired experiences outlined in Table 27. Enjoying the natural beauty, observing wildlife, spending time with friends and family and experiencing solitude were experience opportunities that could be readily obtained.

Table 28: Ability to attain experiences sought by Prince William Sound recreationists.

Experienced Opportunity	Not able to 1	2	3	4	Very able to 5
Enjoy Natural Beauty	0	0	4	17	**79**
Spent time with Family and Friends	4	0	6	17	**73**
Be in a wild undeveloped place	3	3	14	28	**52**
Experience Solitude	1	5	15	32	**46**
Experience Something New	10	3	18	23	**46**
Experience Challenge and Adventure	9	8	19	21	**42**
Observe Wildlife	3	8	22	26	**41**
Fish	18	9	17	17	**39**
Hunt	75	1	5	6	18

What activity were you doing during visits to the shore in PWS?
Out of the 148 respondents (less than half of all respondents) who indicated that they visited the shore 46% indicated their primary activity was kayaking, 21% fishing and12% were sightseeing. The most popular site visited by respondents who indicated they went ashore was Blackstone Bay. Other popular sites are described in table 29.

Table 29: The top 12 most visited shore sites by Prince William Sound recreationists.

Site Visited	Number of Reported Ashore Visits	% of those that responded (n=148)
Blackstone Bay	33	22%
Sawmill Bay	16	11%
Paulson Bay Cabin	13	9%
Decision Point SMP	12	8%
Heather Bay	12	8%
Barry Arm	11	7%
Unakwik Inlet	9	6%
Harriman Fjord	9	6%
Culross Island	9	6%
Port Valdez	9	6%
Simpson Bay	8	5%
Culross Passage	7	5%

Do you have any management actions to Improve Future Visits you can suggest?
Respondents quite often like to provide us with some suggestions as to how to improve management actions to provide for their future experiences. In this case a small number (only 12% of the total) of respondents took the time to respond. Chief amongst their suggestions was improvement to the Whittier launch ramp. There is an even split between those who want to see campsites hardened to reduce impact and those that do not. Additional mooring for those that spent the night on their boats is also suggested.

Table 30: Management actions suggested by for Prince William Sound recreationists that would improve future visits.

Suggested Management Actions to Improve Future Visits	Total	% of Those That Responded (n = 41)
Improve launch ramp at Whittier	14	34%
Harden Campsites	6	15%
Do Not Harden Campsites	6	15%
More Mooring Buoys	5	12%
More Public Use Cabins	4	10%
Reduce Commercial Use	2	5%
Restrict Access or set limits	2	5%
More Law Enforcement	2	5%

Profiles that Characterize Users of the Sound
In order to carefully evaluate and manage for the users of the Sound we merged users into three distinct groups: boaters (ie. small motorized craft, inflatable/skiffs), kayakers and Yacht/Sailboats. These groups were characterized using by: primary activity, % that use shore, and that camp, trip duration, total % time spent on land, desired experience and displacement dynamics, % that relocate, and relocation priorities. The following summarizes these indicators of use. Table 31 provides an evaluation of primary activity by condensed mode of travel. Clearly fishing is the primary activity undertaken by boaters and those in yacht and sail boats.

Table 31: Primary activity sought by boaters, kayakers and yacht/sail boats entering Prince William Sound.

Primary Recreation Activities	Boaters	Kayakers	Yacht/Sail boats
Fishing	**70%**	0%	**46%**
General boating	8%	0%	**16%**
Hiking/backpacking	0%	2%	0%
Hunting	1%	0%	6%
Kayaking	0%	**88%**	4%
Overnight mooring/anchorage	1%	0%	10%
Overnight stay in cabin	1%	2%	0%
Picnicking/family Gathering/berry picking	0%	0%	0%
Primitive camping	1%	2%	0%
Sightseeing	**12%**	2%	**16%**
Subsistence Fishing	2%	0%	2%
Subsistence hunting	0%	0%	0%
Wildlife Viewing	1%	4%	0%
Total Respondents	n=227	n=48	n=50

Table 32 provides a glimpse of the secondary activities sought by these groups and allows better evaluation of the activities engaged in by kayakers. Sightseeing and Wildlife viewing are dominant secondary activities by all groups using the Sound.

Table 32: Secondary recreation activities by boaters, kayakers and yacht/sail boats entering Prince William Sound.

Secondary Recreation Activities	Boaters (n=101)	Kayakers (n=33)	Yacht/Sail Boats (n=38)
Sightseeing	70%	67%	76%
Wildlife Viewing	72%	82%	84%
General boating	84%	12%	21%
Overnight mooring/anchorage	33%	3%	63%
Primitive camping	12%	45%	3%
Hunting	8%	0%	13%
Fishing	88%	30%	63%
Hiking/backpacking	11%	33%	26%
Overnight stay in cabin	10%	9%	11%
Picnicking/family gathering/berry picking	21%	24%	16%
Visiting historic/cultural sites	8%	12%	24%
	n=8	n=4 (33)	n=9 (38)

Based on our respondents 50% of the small boaters and 54% of the Yacht/Sail boats typically spend 2-3 days on the water or engaged in their activity. Kayakers tend to spend more time with 33% of those sampled spending 6 or more days in the Sound at a time (Table 33). An examination of responses from the 44 kayak groups who completed trip diaries showed that in total they spent approximately 261 days during the sampling period in the Sound with over

a 1/3 of active time spent on shore; not including time spent sleeping. By comparison, 221 groups of boaters spent a total of 521 days in the Sound, and only spent about 7% of their trip-time on shore (table 34).

Table 33: Trip Durations of boaters, kayakers and yacht/sail boats entering Prince William Sound.

Trip Duration	Boater	Kayakers	Yacht/Sail
1 day	24%	19%	12%
2-3 days	**50%**	25%	**54%**
4-5 days	14%	23%	24%
6+ days	12%	33%	10%
Total	n=221	n=44	n=49

Table 34: Time spent on shore and camping by boaters, kayakers and yacht/sail boats entering Prince William Sound.

	Boaters	Kayakers	Yacht/Sail
Total Time Spent in PWS (days)	521	261	195
Percentage of time on shore	7%	**36%**	9.74%
Total visits by respondents	n=118	n=135	n=40

The desired experiences of user classes are summarized in ranks 5-1 as follows:

5 - Very Important 4 - Mostly Important 3 – Important 2 - Mostly Unimportant 1 - Not very Important.

The only experience of great importance to all three user types was the ability to observer wildlife. Solitude was primarily important to kayakers while both kayakers and yacht/sail boaters described enjoying natural beauty as being of great importance.

Table 35: The relative importance of experiences sought by boaters, kayakers and yacht/sail boats entering Prince William Sound.

Desired Experience(s)	Boaters (n=232)	Kayakers (n=42)	Yacht/Sail boats (n=51)
Experience solitude	Important	**Very Important**	Important
Observe wildlife	**Very Important**	**Very Important**	**Very Important**
Fish	Mostly Important	Not Important	
Hunt	Mostly Unimportant	Not Important	
Experience something new	Not very Important	**Very Important**	
Experience challenge and adventure	Important	**Very Important**	Important
Be in a wild undeveloped place	Important	**Very Important**	
Enjoy natural beauty	Important	**Very Important**	**Very Important**
Spend time with family and friends	Mostly Important	Not Very Important	
See cultural sites solitude	Not very Important	Not Important	

Traffic Simulation Results

Trip itineraries for trips originating from Anchorage, Cordova and Valdez were collected from May to September in 2008 by University of Arizona. Trip itineraries were collected via self-reported trip diaries. A total of n=341 trip diaries were returned. Of these, n=4 trip itineraries were discarded because of incomplete or incorrect trip data leaving a total of n=338 valid itineraries. The distribution of these trips by launch site (Port) is shown in the table below:

Table 36: Trip itineraries collected at each port for the 2008 summer season in Prince William Sound.

Port	Number of Trips
Cordova	25
Valdez	138
Whittier	175

Trip Itineraries Launches by Port, Day of Week, and Vessel Type

The next step in the construction of the simulation was to analyze the n=338 trip itineraries by the day of week (Monday – Sunday), and Vessel Type (Kayak, Inflatable, Small motorized boat, Motor Yacht or Tour boat) for the months June through August. The following three tables show this summary by Port.

Table 37: Week day simulated departures from the port of Cordova in Prince William Sound.

Day	Vessel Type	% All vessels	% by week day	Accum	Jun Avg	Jul Avg	Aug avg	Jun Max	Jul Max	Aug Max
Mon	Kayak	3%	13%	13%	1	0	0	1	0	0
Mon	Smaller motorized boat	24%	88%	100%	4	2	1	4	2	1
Tue	Kayak	3%	20%	20%	1	1	1	1	1	2
Tue	Motor yacht	3%	20%	40%	1	1	1	1	1	2
Tue	Smaller motorized boat	10%	60%	100%	4	2	3	4	2	5
Wed	Kayak	3%	20%	20%	0	1	1	0	1	1
Wed	Motor yacht	3%	20%	40%	0	1	1	0	1	1
Wed	Smaller motorized boat	10%	60%	100%	1	3	2	1	3	2
Thu	Kayak	3%	50%	50%	1	1	1	2	1	1
Thu	Smaller motorized boat	3%	50%	100%	1	1	1	2	1	1
Fri	Kayak	3%	50%	50%	1	2	2	3	2	2
Fri	Smaller motorized boat	3%	50%	100%	1	2	2	3	2	2
Sat	Smaller motorized boat	7%	100%	100%	6	2	2	9	2	3
Sun	Motor yacht	3%	20%	20%	1	0	1	2	0	1
Sun	Smaller motorized boat	14%	80.%	100%	3	1	4	7	1	4

Table 38 - Week day simulated departures from the port of Valdez in Prince William Sound.

Day	Vessel Type	% All vessels	% by week day	Accum	Jun Avg	Jul Avg	Aug avg	Jun Max	Jul Max	Aug Max
Mon	Motor yacht	3%	22%	22%	2	2	1	3	3	2
Mon	Sailboat	1%	6%	28%	1	1	0	1	1	0
Mon	Smaller motorized boat	9%	72%	100%	8	7	4	9	11	5
Tue	Kayak	1%	8%	8%	0	0	1	1	1	1
Tue	Motor yacht	1%	17%	25%	1	1	1	1	1	2
Tue	Smaller motorized boat	4%	50%	75%	2	2	4	3	4	6
Tue	Tour boat	2%	25%	100%	1	1	2	2	2	3
Wed	Inflatable	1%	7%	7%	1	1	0	1	2	1
Wed	Motor yacht	2%	21%	29%	2	2	1	2	5	2
Wed	Smaller motorized boat	7%	64%	93%	6	6	4	6	14	5
Wed	Tour boat	1%	7%	100%	1	1	0	1	2	1
Thu	Kayak	5%	33%	33%	2	2	2	3	3	6
Thu	Smaller motorized boat	9%	62%	95%	4	4	4	5	5	11
Thu	Tour boat	1%	5%	100%	0	0	0	0	0	1
Fri	Motor yacht	2%	20%	20%	2	2	2	4	4	3
Fri	Smaller motorized boat	8%	73%	93%	8	8	6	13	13	11
Fri	Tour boat	1%	7%	100%	1	1	1	1	1	1
Sat	Kayak	2%	18%	18%	2	2	1	3	4	2
Sat	Motor yacht	1%	12%	29%	2	1	1	2	3	2
Sat	Smaller motorized boat	8%	65%	94%	9	7	5	12	16	8
Sat	Tour boat	1%	6%	100%	1	1	0	1	1	1
Sun	Kayak	1%	3%	3%	1	0	0	1	1	0
Sun	Motor yacht	9%	33%	35%	7	6	2	7	9	4
Sun	Sailboat	1%	5%	40%	1	1	0	1	1	1

Sun	Smaller motorized boat	17%	58%	98%	12	10	3	13	16	7
Sun	Tour boat	1%	3%	100%	1	0	0	1	1	0

Table 39- Week day simulated departures from the port of Whittier in Prince William Sound.

Day	Vessel Type	% All vessels	% by week day	Accum	Jun Avg	Jul Avg	Aug avg	Jun Max	Jul Max	Aug Max
Mon	Inflatable	1%	7%	7%	1	1	0	1	1	0
Mon	Sailboat	2%	21%	29%	2	2	1	3	2	1
Mon	Smaller motorized boat	6%	71%	100%	8	6	2	11	6	2
Tue	Inflatable	1%	9%	9%	1	1	1	1	1	2
Tue	Motor yacht	1%	9%	18%	1	1	1	1	1	2
Tue	Sailboat	1%	18%	36%	1	2	2	1	3	3
Tue	Smaller motorized boat	4%	64%	100%	4	6	8	4	10	11
Wed	Smaller motorized boat	1%	50%	50%	6	9	2	7	9	2
Wed	Tour boat	1%	50%	100%	6	9	2	7	9	2
Thu	Motor yacht	2%	27%	27%	4	2	2	4	3	4
Thu	Smaller motorized boat	7%	73%	100%	10	6	6	10	9	10
Fri	Motor yacht	1%	25%	25%	1	1	5	1	6	5
Fri	Smaller motorized boat	4%	75%	100.%	4	4	15	4	19	15
Sat	Motor yacht	1%	3%	3%	0	1	0	1	1	0
Sat	Sailboat	1%	7%	10%	1	1	1	1	2	1
Sat	Smaller motorized boat	15%	83%	93%	9	18	8	16	26	11
Sat	Tour boat	1%	7%	100%	1	1	1	1	2	1
Sun	Cruise Ship	1%	1%	1%	0	0	0	0	0	0
Sun	Float plane/helicopter	1%	1%	2%	0	0	0	0	0	0
Sun	Inflatable	1%	1%	4%	0	0	0	0	0	0
Sun	Kayak	21%	40%	43%	10	10	5	14	10	7
Sun	Motor yacht	4%	8%	51%	2	2	1	3	2	1
Sun	Sailboat	1%	1%	52%	0	0	0	0	0	0
Sun	Smaller motorized boat	25%	48%	100%	11	12	6	16	12	9

Once the day of week arrivals are calculated for each port for each vessel type, these values are used for the launch schedules for the full summer simulation for the months of June through August. Table 40 illustrates the number of trips generated from each port for the three month simulation for 2008:

Table 40: Number of trip launches into Prince William Sound for 2008 simulation for June, July and August.

Port	Number of Trips 2008
Cordova	298
Valdez	1090
Whittier	1238

Estimated traffic increase to 2018

The increase in traffic to 2018 was simulated based on an assumption that vessel traffic will increase at a rate of 1.5% per annum. This figure is based on "reasonable guestimate" from USFS managers. Over a 10 year period a 1.5% per annum increase translates to a total growth of 116%. This figure does not create a significant change in overall use given the small base numbers in 2008.

Table 41: Number of trip launches into Prince William Sound for 2018 simulation for June, July and August.

Port	Number of Trips 2018
Cordova	345
Valdez	1264
Whittier	1436

Limits of Sustainable Activity Focus Groups

The following section outlined the results from applying the LSA approach. Representatives of each group and each community were represented with the exception of Valdez hunters who were invited but did not attend. In total, 62 people participated in the workshops. Table 42 shows the number of people attending each workshop.

Table 42: LSA Workshop participation – figures shown are maximum attendance through session.

Community	Kayakers	Hunters	Recreational Boaters
Anchorage	11	3	12
Cordova	7	6	6
Valdez	5	0	4
USFS	N/A	N/A	8

Quality of Experience – Kayakers

There is general agreement among kayakers as to the type of experience they are looking for in Prince William Sound. As a group kayakers are seeking contact with "wild places," a wilderness experience, solitude, quiet, enjoyment with nature, wildlife viewing, a feeling of independence, the sense that "you are the first one there," and a general feeling of self sufficiency and independence. The feeling of camaraderie with other kayakers is very strong among the kayak community especially with local kayakers as opposed to large commercial

groups of kayakers. They also enjoy the great diversity of shoreline and the ability to explore new places. They are all aware of the unique combination of mountain, glacier and ocean experiences and the ability to combine kayaking with hiking and wildlife viewing.
Cordova and Valdez kayakers emphasized remoteness and solitude more than Anchorage kayakers. Valdez and Cordova kayakers emphasized the importance of undeveloped shoreline, and take pleasure in "low impact" camping along the shoreline. They generally felt that it was "too busy" on the western side of the sound and that the remoteness from Anchorage was an important factor in maintaining their ability to have a true wilderness experience and attain the feeling of solitude. Kayakers also enjoy exploring historic sites and old ruins.

Anchorage kayakers were acutely aware of the easy access they have to Prince William Sound and the ability to quickly get into a wilderness experience from the urban environment of Anchorage.

What are the key factors that contribute to these experiences?

- Ocean, mountain, glacier, scenery
- Bays that big boats cannot get into.
- Convenient access
- Remoteness
- Independence / self sufficiency
- Low impact camping
- Camaraderie with other kayakers
- Water taxi's can provide a positive service in distributing kayakers.
- Wakes, sound or noise impact was significant on holiday weekends.

Quality of Experience – Small Motorized and Yacht/Sail Boats
Like the kayakers, the focus of the recreational boating community (includes yacht and sail boats) is the experience of nature. Activities associated with this group include wildlife viewing, glacier viewing, fishing, hiking, photography, beach picnics, beach combing, clam digging, shrimping, exploring historic sites, boating or sailing accompanied by whales or porpoises.

There is a much stronger social or family orientation expressed with this group as compared to kayakers. This is because with motorized boats and larger vessels it is possible to travel as a group with greater mobility and speed than kayaks. Also the larger vessels provide on-board facilities for sleeping and eating making it possible to spend long periods out in comfort for everyone including children and the elderly. The social orientation was expressed most strongly by the community groups represented but was not mentioned by USFS managers. Community respondents emphasized the importance of experiencing Prince William Sound as part of a social activity with family and friends. The Anchorage workshop attendees were particularly aware of the fact that Prince William Sound is their "backyard" and easy access to wilderness from Anchorage was a special asset and privilege.

USFS managers emphasized solitude and activities such as fishing, hunting, wildlife viewing and hiking. They were very much focused on the idea of a wilderness experience with very little contact with other users. Some were extremely sensitive to contact with other users with solitude a highest priority, whereas others were more tolerant of other users as long as there weren't more than a few boats sharing the same bay or fjord.

What are the key factors that contribute to these experiences?

- Availability of resource (for fishing, hunting, berry picking, clamming)
- Presence of wildlife
- Low tide making beaches available for beach combing, clamming picnicking
- Low on-shore development
- Low use levels
- Favorable weather
- Availability of anchorages
- Scenery – glaciers, wildlife, mountains
- Wilderness character

Quality of Experience – Hunters

The strong consensus among hunters is the focus on the availability of the resource. The availability of fish and game varies by location and season within Prince William Sound and for residents of the three communities attending workshops, the quality of the hunting experience has to do with the abundance of the resource as it relates to hunting pressure on wildlife populations. Many of the hunters participating in the workshops consider themselves to be "meat" or subsistence hunters, that is, they eat the game that they shoot. As a result many have had years of experience hunting in PWS and have noted changes in the wildlife populations. Anchorage hunters specifically commented on the decline in the deer and bear populations.

Hunters at the workshops all agreed that solitude was an important part of the experience. One Anchorage hunter noted that there was a safety issue related to this as well since you are less likely to be shot by another hunter if you had the place to yourself. Sport hunters are often brought in by guides who may bring in hunting parties. There is a strong perception among long time residents of PWS that there is a difference between locals who tend to be subsistence hunters and visitors who tend to be hunting for sport or recreation. Locals share the value of solitude and therefore will not intrude on another hunter in a bay, they will move on. Sport hunters are perceived to have little or no respect for the importance of solitude and will often intrude on a bay without asking thus diminishing the experience of the local hunter. This creates feelings that range from "uncomfortable" to one of animosity and is largely due to lack of communication and knowledge about these "unwritten rules".

Serendipity also plays a part in the experience hunters have in PWS. A hunting trip may turn into a berry picking, beach combing or simply cruising around PWS to watch whales and enjoy the scenery.

What are the key factors that contribute to these experiences?

- Availability of resource (for fishing and hunting) (location and seasonally specific)
- Little or no competition with other hunters
- Low on-shore development
- Low use levels
- Favorable weather
- Availability of anchorages
- Wilderness character
- Increasing pressure – especially on the west side of PWS, "sport hunters" may displace locals either to other bays or they may hunt later in the season. Hunters have

noted a decline in wildlife populations and are concerned that the resource is not being properly managed.
- Bear baiting was seen as a problem by some hunters who felt the practice should be prohibited.

The results for each recreational group in terms of preferences, expectations and tolerances for varying densities of each user type are discussed in the following sections.

For *Expected Peak Season LSA* the evaluations were more variable. The reason behind this variability is that some users had not visited some of the locations, so opted out of the evaluation or made an evaluation based on 'what they imagined' the traffic to be. The users that had visited the area may or may not have experienced the traffic during peak periods. Generally however, the highest densities were assigned to Blackstone Bay attributed to the close proximity to Whittier (and therefore with the easiest access to the greatest population) and Sheep and Simpson Bays because these bays are smaller with relatively high use levels compared to the area of the bay. Unakwik Inlet had the lowest ratings primarily due to the large size of the inlet and the relatively low use.

The median values for *Maximum Tolerable LSA* ratings were fairly consistent between communities for each bay. Also the evaluations were fairly consistent by vessel type. Anchorage kayakers have the highest tolerance for other kayakers in Blackstone Bay (which has an existing LSA of D). This is largely due to the large size of the bay and the fact that this level of use is already expected for Blackstone Bay. Valdez kayakers also had high tolerance for other kayakers in Sheep and Simpson Bays. Anchorage kayakers had the lowest tolerance for other vessel types at Unakwik Inlet (LSA of B for both small motorized boats and yachts/sailboats). Cordova kayakers also had low tolerance for yachts/sailboats at Unakwik Inlet.

When one compares the *Expected* LSA for each vessel type and each location with the *Maximum Tolerable LSA* for the corresponding locations, Anchorage kayakers felt that *Expected* levels of use for all vessel types during peak times were equal to their thresholds for *Maximum Tolerable* in all locations except Sheep and Simpson Bay. If confronted with these levels they would either be displaced to quieter locations or they would try to schedule trips at alternative times. Some Anchorage kayakers indicated that there are already locations they currently avoid because of the unacceptably high use levels.

The picture for Valdez and Cordova kayakers in comparing *Expected* LSA to *Maximum Tolerable LSA* is more complex. Both expected Blackstone Bay to currently exceed what they think of as Maximum Tolerable for all vessel types. They feel Sheep and Simpson Bays have levels of use by motor yachts and sailboats as well as small motorized boats that meet or exceed their tolerance, but has additional room for kayakers before reaching a Maximum Tolerable limit. At Unakwik Inlet, Valdez and Cordova kayakers perceive that use levels are less than what they consider to be *Maximum Tolerable* for small motorized boats during peak periods. However, Cordova kayakers expect that Unakwik Inlet is at their Maximum Tolerable level during peak periods for motorized yachts and sailboats.

Table 44 shows the median LSA values for recreational boaters in Anchorage, Valdez and Cordova. The table also shows LSA ratings from USFS managers who pre-tested the LSA workshop format posing as recreational boaters. The USFS managers had the greatest variation in LSA scores for *Ideal LSA* and *Maximum Tolerable LSA* (see Appendix 3 Raw

scores for LSA ratings in community workshops) reflecting the diversity of interests in this group. It was apparent during the workshop that some USFS managers are subsistence hunters and fisherman and their scores are more similar to those of the hunter groups discussed in the next section. Other USFS managers were more representative of the recreational boaters, though all place high value on solitude.LSA scores are reported in Table 44 for USFS managers. However the specific results are not discussed further here because the group is not representative of the recreational boating community. Most Recreational Boaters, in the LSA workshops have vessels that are self sufficient in that they provide facilities for sleeping, eating and entertaining onboard. This allows for comfortable accommodation for all ages and physical abilities. The fact that this group do not tend to camp onshore, means that they tend to compete less with kayakers for campsites. They do however come onshore for other land based activities like berry picking, hiking, and picnicking.

Generally recreational boaters have a more social orientation than either kayakers or hunters; this is reflected in the generally higher LSA ratings for *Ideal LSA* than the other user groups. The reasons expressed for the higher ratings include the concept that other boats in the area are good (in case of emergencies) and that kayaks cause little or no conflict. Valdez boaters had higher *Ideal LSA* ratings for kayaks and small motorized boats at Blackstone Bay. Their reasoning was that this is the busiest bay and they expect it to be busy and it may be appropriate to have heavy traffic in this setting. The perception that kayaks have little impact on the feeling of wilderness is also reflected in the high LSA ratings for kayaks by all 3 recreational boating communities for allocations. Motor yachts and sailboats are seen to have more impact than motor boats of the same size however recreational boaters as a group are much more tolerant of other boats than kayakers and hunters across all locations.

Maximum Tolerable LSA ratings are generally high for Blackstone Bay for kayaks as recreational boaters do not see them as having a big impact either on traffic or on sense of solitude. Also there is an expectation that Blackstone Bay will be busy because of the proximity to Whittier and the opportunity to view glaciers. Respondents tend to be more tolerant of higher use levels in areas where higher use is expected and are known destinations for commercial tour boats and recreational boats. One of the key factors determining LSA levels for large boats is the availability of safe anchorages. Local knowledge and maps and guidebooks that show anchorages are valuable resources for recreational boaters in PWS. This is reinforced by the LSA scores that show *Maximum Tolerable LSA* consistently lower than *Expected Peak Season LSA* across all locations.

Hunters in our groups generally hunted from small motorized boats. Because hunting season is generally in the spring and fall, they are generally not in competition with the heavy summer kayaking and recreational boating season. Hunters see little problem with kayakers camping on-shore as they are quiet and don't interrupt game hunting. Therefore, the LSA ratings for small motorized boats are of most relevance when analyzing hunter perceptions. Cordova hunters had no opinion about conditions in Blackstone Bay for kayaks and motor Yachts and sailboats and did not express the same level of hunting pressure as Anchorage hunters. Their scores show only Blackstone Bay under unacceptable traffic levels for small motorized boats. Interestingly LSA scores for *Maximum Tolerable LSA* were higher for Cordova Hunters for Blackstone and Unakwik Inlet (Anchorage LSA = B, Cordova LSA = C). This may be because Anchorage Hunters have more experience with high levels of hunting traffic and are better able to judge the impact of vessel density on hunting quality of experience (Table 45).

Table 43: The median LSA values for kayakers in Anchorage, Valdez and Cordova. The evaluations for *Ideal LSA* were consistent across all communities for all vessel types with high value placed on low density use (LSA of A = no other vessels or B = 0.03 vessels/sq km) across all three locations. These ratings are consistent with the high value kayakers expressed for solitude and wilderness experience in the Quality of Experience discussion.

Level of Sustainable Activity – Kayakers

	Blackstone Bay	**Unakwik Inlet**	**Sheep and Simpson Bays**	**Blackstone Bay**	**Unakwik Inlet**	**Sheep and Simpson Bays**	**Blackstone Bay**	**Unakwik Inlet**	**Sheep and Simpson Bays**
	Kayaker Rating Kayaks			**Kayakers Rating Small Motorized Boats**			**Kayakers Rating Motor Yachts and Sailboats**		
	Ideal LSA			***Ideal LSA***			***Ideal LSA***		
Anchorage Kayakers	B	A	A	A	A	A	A	A	A
Valdez Kayakers	A	A	B	A	A	A	B	B	A
Cordova Kayakers	A	A	A	A	A	A	A	A	A
	Expected Peak Season LSA			***Expected Peak Season LSA***			***Expected Peak Season LSA***		
Anchorage Kayakers	D	B	B	C	B	C	C	B	C
Valdez Kayakers	D	B	C	D	B	C	C	B	C
Cordova Kayakers	C	A	B	D	B	C	C	B	C
	Maximum Tolerable LSA			***Maximum Tolerable LSA***			***Maximum Tolerable LSA***		
Anchorage Kayakers	D	B	C	C	B	C	C	B	C
Valdez Kayakers	C	B-C	D	C	C	C	C	C	C
Cordova Kayakers	C	C	C	C	C	D	C	B	C

Table 44: Median LSA Values for recreational boaters in Anchorage, Valdez and Cordova. USFS Managers pre-tested the LSA workshop format posing as recreational boaters.

Level of Sustainable Activity – Recreational Motor Boats, Yacht and Sail Boats

	Blackstone Bay	**Unakwik Inlet**	**Sheep and Simpson Bays**	**Blackstone Bay**	**Unakwik Inlet**	**Sheep and Simpson Bays**	**Blackstone Bay**	**Unakwik Inlet**	**Sheep and Simpson Bays**
	Recreational Boaters Rating Kayaks			**Recreational Boaters Rating Small Motorized Boats**			**Recreational Boaters Rating Motor Yachts and Sailboats**		
	Ideal LSA			***Ideal LSA***			***Ideal LSA***		
USFS Managers	C	B	C	A	B	B	B	A	A
Anchorage Boaters	A	B	A	A	B	A	A	A	A
Valdez Boaters	C	B	B	D	B	B	A	B	B
Cordova Boaters	A	B	A	A	B	A	A	B	A
	Expected Peak Season LSA			***Expected Peak Season LSA***			***Expected Peak Season LSA***		
USFS Managers	D	A	B	E	A	C	B	A	C
Anchorage Boaters	D	C	B	C	C	C	C	B	C
Valdez Boaters	C	B	B	D	B	C	A	B	C
Cordova Boaters	E	D	C	D-E	D	D	E	C	C
	Maximum Tolerable LSA			***Maximum Tolerable LSA***			***Maximum Tolerable LSA***		
USFS Managers	D	C	C	D	C	D	C	C	C
Anchorage Boaters	D	D	D	D	C	D	D	C	C
Valdez Boaters	D	D	C	E	C	E	B	C	C
Cordova Boaters	E	D	D	C	D	C-D	D	C	D

Table 45: The median LSA values for hunters in Anchorage and Cordova. No values are reported for Valdez hunters as invited members of the community failed to attend the workshop. For Anchorage and Cordova hunters there is a high level of agreement on the *Ideal LSA* with level A and B ratings across all locations for all vessel types. This is consistent with the expressed value hunters place on solitude and their preference for low competition when hunting. Anchorage hunters expressed concern that PWS was getting too much pressure from hunters and that they were already getting displaced by heavy hunting use or depletion of game stocks.

Level of Sustainable Activity – Hunters

	Blackstone Bay	**Unakwik Inlet**	**Sheep and Simpson Bays**	**Blackstone Bay**	**Unakwik Inlet**	**Sheep and Simpson Bays**	**Blackstone Bay**	**Unakwik Inlet**	**Sheep and Simpson Bays**
	Hunters Rating Kayaks			**Hunters Rating Small Motorized Boats**			**Hunters Rating Motor Yachts and Sailboats**		
	Ideal LSA			***Ideal LSA***			***Ideal LSA***		
Anchorage Hunters	A	A	A	B	A	A	A	A	A
Valdez Hunters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cordova Hunters	A	B	A	A	B	A	A	B	A
	Expected Peak Season LSA			***Expected Peak Season LSA***			***Expected Peak Season LSA***		
Anchorage Hunters	C	B	N/A	E	D	C	B	B	C
Valdez Hunters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cordova Hunters	No rating	A	B	E	B	B	No rating	B	C
	Maximum Tolerable LSA			***Maximum Tolerable LSA***			***Maximum Tolerable LSA***		
Anchorage Hunters	B	B	C	B	B	C	B	A	B
Valdez Hunters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cordova Hunters	No rating	C	Uncertain	C	C	C	No rating	C	D

Level of Sustainable Activity - Comparisons between Groups
When one compares and contrasts the three communities and the three recreational user groups there are some similarities and distinct differences.

Generally hunters have the highest requirements for solitude and the lowest tolerance for competition. Generally they prefer "1 boat per bay" and this "unwritten law" is generally acknowledged and respected among subsistence hunters in local communities like Cordova. However conflict with other hunters occurs when this concept is not recognized – especially by commercial hunting guides. The key issues relating to the hunter groups have to do with the management of the hunting resource. Anchorage hunters felt that wildlife stocks were overhunted and that the practice of bear-baiting was undesirable. Hunting pressures, primarily from sports hunters as opposed to subsistence hunters are considered to be intolerable during the peak hunting season, which causes local hunters to either move from traditional hunting areas or hunt during the shoulder seasons. Hunters are generally in PWS in the spring and fall and therefore do not overlap on the main summer recreational boating season. They therefore see little conflicts with kayaks and other recreational boats so the main competition is with other hunters.

Kayakers follow hunters in the high value they place on solitude. This group values "low impact" camping, self-sufficiency, camaraderie with other kayakers, and contact with nature. They are generally tolerant of other kayakers because of the quiet mode of transportation and strongly shared values of low impact recreation. However they are less tolerant of small motorized boats because of the noise, speed, wake and the impact it has on quiet and solitude and if they camp onshore they compete for campsites. They are more tolerant of the larger motor yachts and sailboats because these boats are self contained and do not compete for camping sites. Valdez kayakers were particularly opposed to the practice of bear-baiting because of the visual impact of litter from baked goods and potential danger posed by bears attracted to shoreline campsites.

Recreational boaters attending the LSA workshops were generally sailing motor yachts and sailboats. Smaller motorized boats like cabin cruisers and runabouts and trailer boats were not represented among the respondents. Though this group, like the others, value solitude and wilderness experience as the "Ideal" LSA, they are, as a group, more socially oriented. They see little conflict or competition with kayaks and have higher tolerance to other boats than hunters or kayakers. For this group the availability of anchorages is critical. Because they are self sufficient and not reliant on onshore campsites, they tend not to have conflicts with kayakers and when they travel kayakers tend to hug the shoreline whereas recreational boaters and especially motorized yachts and sailboats use the open water. This group is quite aware of safety issues and mentioned the problem of the dangers for inexperienced sailors in any sized motor boat running out of fuel, unaware of where to find safe shelter in inclement weather, poorly equipped or maintained boats, and inadequate seamanship given the remoteness of many of the destinations in PWS.

When comparing all three communities and user groups, it is apparent that all groups value feelings of solitude. With exception of USFS managers, the median rating for *Ideal LSA* across all bays, for all communities for all recreational groups was A (no boats) or B (.03 vessels / sq

km). Those assigning a rating of A, liked the idea of "being the first one there" or the feeling of "having the place to yourself". Those assigning a value of B felt that a few other vessels were positive for safety reasons. Valdez recreation boaters rated Blackstone Bay LSA as C because they felt that Blackstone Bay was unique as a tourist destination because of its proximity to Anchorage and because of the opportunity to view glaciers and wildlife in an already busy bay.

In most cases, user's median ratings for *Expected Peak Season LSA* were higher, or much higher than *Ideal LSA*. This is expected given that *Ideal LSA* ratings were either A or B. However *Maximum Tolerable LSA* ratings varied considerably between recreation types. Kayakers mostly assigned LSA C for *Maximum Tolerable LSA* across all bays and all vessel types with a few B and D ratings. Hunters also had relatively low *Maximum Tolerable LSA* ratings with mostly LSA B and C ratings for all locations. Recreational Boaters had higher rating across all bays and vessel types with median *Maximum Tolerable LSA* ratings of C and with and even a few E ratings. These ratings are consistent with what users expressed in the workshops for Quality of Experience criteria with recreational boaters being more social than kayakers or hunters.

The Impact of Distance from Port, Size and Shape of the Destination on LSA

Blackstone Bay, Unakwik Inlet and Sheep and Simpson Bays were selected because of differences in the distance from Anchorage, differences in use levels, differences in total area and shape and complexity of the shoreline. Workshop participants did consider these variables as they were assigning LSA levels especially for *Maximum Tolerable LSA*, however there was not a clear difference in LSA ratings across use types. Comments made by the boating communities in Valdez and Cordova that the distance from Anchorage provides "some protection" from boating traffic. They feel the distance from Anchorage is an important factor in the lower use levels and the ability to attain feelings of solitude when paddling or boating in PWS. The reverse of this sentiment is true for Anchorage boaters who feel that the Western side of PWS is very busy and, with the opening of the Whittier Tunnel, there is increasing pressure from small, trailer-able motor boats.

Human Use Management Suggestions

A number of focus group members provided management suggestions. There were three ideas consistently suggested by one or more individuals that had broad support from other members of focus groups.

- Improved enforcement of game hunting laws– especially poaching as well as increased efforts to quantify game/wildlife stocks as there is a pervasive perception that bear and deer are overhunted.
- Eliminate practice of bear baiting and hunting from boats. These two practices create conflicts and safety concerns for both hunters and non-hunters.
- Need to educate short term visitors and newer visitors about low impact recreation both on environment and intrusive behavior on other visitors as well as increased education about Sound-specific boating safety relating to equipment, fuel, weather patterns and navigation.

Other suggestions made by individuals fell into the following three general categories:

Suggestions for managing use levels

Management suggestions by workshop participants relating to hunting include:

- Improved enforcement of game hunting laws– especially poaching.
- Monitor wildlife population and quantify game stocks. There is a strong perception that bear and deer are overhunted. Long term hunters in PWS also noted that wildlife are more wary of hunters than in earlier days so hunting pressure may be changing the behavior of wildlife.
- Limit hunting done with a sport license

Managing behavior of recreational boaters relative to safety, solitude and wilderness character

- Need to educate short term visitors about low impact recreation both on environment and intrusive behavior on other visitors.
- Need to educate short term visitors boating safety relating to equipment, fuel, weather patterns and reading navigation charts.
- "Leave no trace" guidelines for boating especially relating to noise and wake for non-motorized vessels and on-shore campsites. Also respect for other boaters in a wilderness setting and wildlife interactions especially marine mammals.

Issues relating to erosion of wilderness character

- Place a moratorium on trail building
- Moratorium on new outfitters
- Limit number of transporters allowed to operate out of harbors
- Limit size of commercial kayak parties (to less than 15)
- Prevent floating lodges and floating hotels
- Maintain Wilderness image of PWS avoid turning PWS into "Disneyland"

DISCUSSION

The following is a synthesis of results from transect-based kayak and boat observations, PWS user questionnaire survey, and stakeholder workshops.

Small motorized boats are travel mode of choice by over 65% of respondents and were approximately 62-66% of all recreation vessels detected during transect surveys through all three seasons of use. This accord between questionnaire and transect survey results was not echoed in results for kayaks which were 14% of our respondents but only represented 2-3% of detections during spring and summer. This could be a result of weakness in our transect sampling procedures which due to our one-time inventory attempt for much of the PWS region did not allowed for computation of detection coefficient estimates for across vessel types. Clearly larger, fast moving vessels producing motorized noise and likely have higher detection rates than slower moving silent kayaks.

Given our lack of control for vessel type our encounters per hour number should be used only in terms of comparing relative levels of activity. For example describing regions as High, Medium, and Low overall vessel use or evaluating relative proportions of total use compared to permitted use. Though detections per hour estimates can be predicted for both spring and fall boat surveys, these seasons of effort totaled only approximate 1/10 of the total amount of observation time. Though spring and fall transect surveys covered larger amounts of shoreline they spent

significantly less total time making observations. As a result they also show a higher overall degree of variability which might be real as fall and spring use appears to be more patchy in the region (Poe and Greenwood 2010) but may also result from lower sample effort. As such they likely have less utility for making strong comparisons relative to overall vessel use.

Density surfaces produced for all seasons may prove more useful for spring and fall analyses as they benefit from a point distribution set including several hundred user-identified locations from 2005 and 2008 questionnaires. Further our work comparing transect observations to reported use locations from groups departing from ports are useful for describing relative use intensities within the Sound. This survey technique is useful for systems with relatively few entry points and should be seem as a valuable tool for managers in the region.

When comparing our transect observations to commercial recreation use under Special Use Permit by the Forest Service (ie., those recreation activities that during any part of the trip use guides to access the uplands managed by the CNF) we found these activities represent a small portion of the overall recreation use in the Sound. In Harriman Fiord and Barry arm the % permitted commercial was highest approaching 20% but in most areas these groups are in the single digit percentages of overall use.

Our density predictions and transect surveys demonstrate a clear relationship with the distance from ports and regional variation in use intensity. This has been observed in an earlier study of western Prince William Sound (Murphy *et al*. 2004). It is very clear from comments made by the boating communities in Valdez and Cordova that the distance from Anchorage provides "some protection" from boating traffic. They feel the distance from Anchorage is an important factor in the lower use levels and the ability to attain feelings of solitude when paddling or boating in PWS. The reverse of this sentiment is true for Anchorage boaters who feel that the Western side of PWS is very busy and, with the opening of the Whittier Tunnel, there is increasing pressure from those that use trailers to haul motor boats. Land and resource managers should keep this reality of the system mind as they attempt to plan for solitude opportunities within the region.

Primary recreation activities reported by respondents were fishing (54%), kayaking (13%) and sightseeing (11%). When asked about desired recreational experiences during these activities, respondents prioritized based on 1) Enjoying natural beauty 2) spending time with family and friends 3) fishing (primarily salt water) and 4) being in a wild/undeveloped place. Specific choices about destinations were made based on 1) Good fishing (in saltwater) 2) Glacier Viewing, and 3) Wildlife Viewing. The ability to view wildlife was the only activity identified as "very important" to three categories of users (Kayakers, small motorized boaters, yacht and sail boaters.

There are no significant differences between single-day and multiple-day trippers in their satisfaction; rate of negative encounters or displacement rates, nor by Alaska Resident or out of state visitor. All users reported satisfaction levels above 90-95% which seems exceedingly high for a visitor use satisfaction study.

Although other studies frequently mention crowding or high number of encounters as being the reasons for displacement (Hall & Cole 2007), it appears that most visitors to PWS can still get to

their planned destinations and obtain the type of solitude and other opportunities that they desire. Contrary to what might be seen as popular thought, too many visitors or crowding was barely mentioned by questionnaire respondents and no respondents reported displacement as a result of interactions with others; though 10% reported negative encounters. In terms of being able to achieve experiences associated with wildland experiences, respondents specifically reported they were able to experience solitude with 78% selecting 4 or 5 on a five point scale indicating their ability to achieve solitude. Similarly solitude was a strong motivator for survey respondents but only 10% identified it as prominent reason for choosing their destination; alluding the possibility that the ability to achieve solitude is not a limiting factor throughout PWS as a whole. There was no correlation between longer trips and the desire for solitude. Similarly, when asked *if* respondents were to feel crowded what would they typically do, the overwhelming response (86%) was to relocate to another location; suggesting that solitude opportunities are not limited. Certainly there are problems with such theoretical action questions but results suggest that there are enough places still available to retreat from potential crowding experiences in the Sound

This is however counter to some of the focus group perceptions relative to *Expected* vs. Maximum Tolerable LSA levels for some of our scenario areas. It is pretty clear that users perceive Blackstone to be busy by kayaker standards and at or above capacity during peak periods. Unakwik Inlet is the other extreme, as the largest body of water studies and with low perceived use levels at peak periods and the large effort required to get to Unakwik Inlet (over 65 km from Whittier, over 75 km from Valdez, and over 110 km from Cordova) it appears that users not only expect low use but also would be annoyed if they arrived and found higher than expected use. These conclusions should be regarded with some caution given the variability of judgements for *Expected Peak Season LSA* as described earlier. Further these group members representing kayak and hunting experts in the region appeared to be are primarily motivated by solitude and for example believe that Blackstone Bay currently has levels of use that would prevent their use during peak season times. The motivation of solitude was not as strongly professed in questionnaires. Additionally, a classic problem of evaluation perceived crowding compared to actual experiential reporting from trips offers a possible explanation. It could also be longer time users or experts in the region from these two focus groups are responding to increased use in the system over a longer time scale of experience. However it should be noted that over 80% of those surveyed entering PWS were Alaska residents and that over 98% of those respondents reported using the Sound two or more times a year; presumably giving them some familiarity and insights into use dynamics.

When one considers the most common issues identified by focus groups, the professed sensitivity of crowding for the hunter user groups, and the potential impacts that hunters can have on other user groups it is clear more should be invested in the management of this group. Hunting is certainly a key experience sought by individuals using the uplands of Prince William Sound and managers should actively work to facilitate this activity. Unfortunately our efforts were unable to characterize this group with any significant depth or specificity and future work may have to take alternative approaches to engaging this group.

CONCLUSION AND RECOMMENDATIONS

Given that there are some key experiences sought by recreationists in the Sound and the system is not in "crisis" mode in terms of conflict, crowding or other social impacts, we recommend planning approaches which identify a few key issues and attempt to make systematic progress on them. We submit that attempts at addressing key issues should focus primarily on assessing, managing, and engaging with private recreationists as they constitute the majority of use in the region. This is problematic as these users typically have little connection or relationships with land and resource managers. Further, in many cases their direct use of the uplands may only account for a small portion of their trip; though certainly their activities have a potential social effect on those lands. Given the vast extent of the region opportunities for managers to engage users are limited to ports of entry. This suggests that indirect management efforts in terms of education or management actions that passively affect, direct or deflect use (ie., campsite hardening or other low impact facility options and outreach efforts identifying areas where more use is appropriate) are likely the best for this system.

Managers should attempt to foster more local citizen involvement in reaching out to visitors to the region. Our experience with individuals in our focus groups highlighted a perceived disparity in behavioral norms between *local* Sound residents and other residents of Alaska, as well as visitors, who may have less familiarity with traditions of use in the region. Managers should attempt to share the perspectives and advice of locals in best use practices that can be directed at newer users of the Sound. Such an effort could be combined with collecting systematic input on emerging issues in the region from local experts like those that we brought together in focus groups.

Much in wilderness/wildland recreation research and management focuses on evaluating or limiting numbers of individuals using the landscape in order to predict and reduce the social impacts. Our work highlights some of the complexities that can be missed by such approaches of singular focus. In the Sound, perceptions about encounters seem to have more do with expectations, behaviors exhibited and witnessed, as well as the specific opportunities desired by different groups of recreationists. We suggest that future efforts attempting to assess quality of experience in Prince William Sound focus on understanding recreation behavioral norms and user expectations as approaches to further elucidate potential stressors on recreation experience.

Specific recommendations and opportunities for management include:

- The knowledge gaps associated with hunting and the sensitivity of this group to changes in use levels and competition make them, above all, most likely to experience declines in quality of experience in Prince William Sound. *Land and resource managers need to develop a more comprehensive understanding of hunting practices in the Sound between what is likely to be three different groups of individuals (subsistence/local sport, commercial sport, and sport hunters from outside the Sound) likely with differing sets of motivations, expectations and behavioural norms. Managers need to work to understand the differences between these groups and assist in the development of a code of practice within the hunting community as a whole that compliments local traditional hunting and fishing practices in the Sound.*

- There is an intuitively obvious relationship between healthy game populations and perceptions about competition that both have significant impacts on hunter user experience. The current management approach in the region is for land managers to be responsible for user experience and game managers (ADF&G) for populations of harvest species. *A management partnership between ADF&G and upland managers (principle among them the Chugach National Forest) should be sought that can better integrate quality hunter experience with game population management.*

- The perception of crowding does not currently seem to be a widespread concern in Prince William Sound that is negatively impacting user experience. It appears recreation boaters and kayakers to the region are able to achieve their desired solitude feelings of being in a wild landscape and local users seem to have enough experience in the region to know where and when to avoid crowds. *Managers should attempt to maintain this dynamic by promoting/publicizing realistic expectations of experience for users in the region and products from this research might be employed to do so.*

- There is a diversity of experience going beyond solitude and recognizing the other dominant motivations in the Sound such as wildlife and glacier viewing, fishing and spending time with family and friends may not be solitude dependent. *Future planning by upland managers should recognize the reality of use densities and desired opportunities. It should focus on facilitating an array of key recreation experiences including: wildlife viewing, glacier viewing, overnight opportunities in the vicinity of glaciers and hunting within a wilderness setting. Under this approach solitude is certainly an important component of these experiences but it shouldn't solely drive their management.*

- Small privately owned, motorized boats that can be transported on a trailer represent the largest portion of use in Prince William Sound. The majority of these boats enter the Sound through the Whittier tunnel and their numbers are tracked by tunnel ownership for purposes of payment. Similarly, launching vehicles from the harbor of Valdez or Cordova requires payment of a fee and those numbers are similarly tracked. A gross level of monitoring in terms of boats being launched from these areas would lend itself to detecting changes in the total population of this user group and for simulating future use in the region. *Managers should explore a method by which harbor masters and the Anton Memorial ("Whittier") tunnel management cooperate to share boat launch information for future gross use level small boat (and possibly kayak) monitoring.*

- Blackstone bay was consistently identified as a busy destination by transect data, responses to questionnaires and focus group evaluations. This is a distinction from the three areas with the highest traffic: Passage Canal, Culross Passage and Port Valdez as these are more regularly used as corridors for travel than specific destinations. *Clearly Blackstone Bay should figure prominently in any subsequent evaluations or research of user experience in the Sound for destinations that typify High use. Similar equivalent tidewater glacier areas with Medium (e.g., Harriman Fiord) and Low (College Fiord and Icy Bay) human use dynamics offer opportunities to study recreation and ecosystem interactions along a gradient in these unique environments.*

- Our seasonal use density prediction raster layers offer managers the ability to look at Prince William Sound as a series of subregions, at the larger AA level (n=31) or GA level (n=592), to explore interactions between recreation use and other system components such as sensitive species or other human uses. *Future efforts launched by land and resource managers have a continuous baseline of seasonal use distribution that should be used for regional planning and can be incorporated into monitoring or modeling efforts.*

ACKNOWLEDGEMENTS

The authors would like to acknowledge the support of the Exxon Valdez Oil Trustees for support to undertake this research. The Chugach National Forest, together with the University of Arizona leveraged many key staff persons to assist in data including: Bruce Campbell, Matt Murphy, Merlyn Schelske, Adam Cross, Sean Meade, Ben Houdek, Mary Ann Smith, Jessica Fraver, Laura Kennedy, Bob Venable, Laura Applebaum, Jeannie Kirkland and Christine Dunlap. These efforts were overseen by two talented crew leaders in Chris Stinson and Coleen Brown. GIS and document editing support was contributed by Chandra Poe. Earlier versions of the report were greatly improved based on reviews completed by Courtney Brown, Dale Blahna, and Andrew Ackerman.

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Observation Datasheet

Date: ________________ **Location:** ______________________

Day: _______________

Transect/ Survey ID	**Encounter**	**Group**	**Vessel Observ Waypt**	**Vessel Type**	**Time First observed**	**Distance**	**Noise *H M L***	**Closest Distance**	**Time Last observed**	**Vessel Moving ?**	**Obs**
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	

EXAMPLE: Observation Datasheet

Date: 02 Aug 2007 **Location:** Simpson Bay N. Finger

Day: Wednesday

Transect/ Survey ID	Encounter	Group	Vessel Observ Waypt	Vessel Type	Time first observed	Distance	Noise H M L	Closest distance	Time last observed	Vessel moving?	Obs
09	29	A	52	K OS OST IN CC MY TC CF FW HE S OT	1051	100 500 1 >1	H	100 500 1 >1	1057	Y N	LK
09	30	B	53	K OS OST IN CC MY TC CF FW HE S OT	1055	100 500 1 >1	L	100 500 1 >1	1056	Y N	LK
09	31	C	54	K OS OST IN CC MY TC CF FW HE S OT	1216	100 500 1 >1	H	100 500 1 >1	1219	Y N	LK
09	32	D	55	K OS OST IN CC MY TC CF FW HE S OT	1312	100 500 1 >1	L	100 500 1 >1	1312	Y N	LK
NS_M	33	C	58	K OS OST IN CC MY TC CF FW HE S OT	1411	100 500 1 >1	M	100 500 1 >1	1414	Y N	LK
11	34	E	62	K OS OST IN CC MY TC CF FW HE S OT	1758	100 500 1 >1	M	100 500 1 >1	1809	Y N	LK
11	35	E	63	K OS OST IN CC MY TC CF FW HE S OT	1809	100 500 1 >1	M	100 500 1 >1	1820	Y N	LK
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	
				K OS OST IN CC MY TC CF FW HE S OT		100 500 1 >1		100 500 1 >1		Y N	

Observation Datasheet (example): back of datasheet

Notes:

29 – 4 singl, 2 dbl NOLS group

30 – barge heading toward Cordova

31 – 2 ppl (man and boy) fishing for pinks in small motorized skiff, spoke to the man

32 – Coast Guard helicopter

33 – same skiff as 31, drove into back of bay then turned around

34 – blue and white CC with 2 red kayaks strapped to roof

35 – blue and white CC went ashore, 3 ppl, 2 dogs

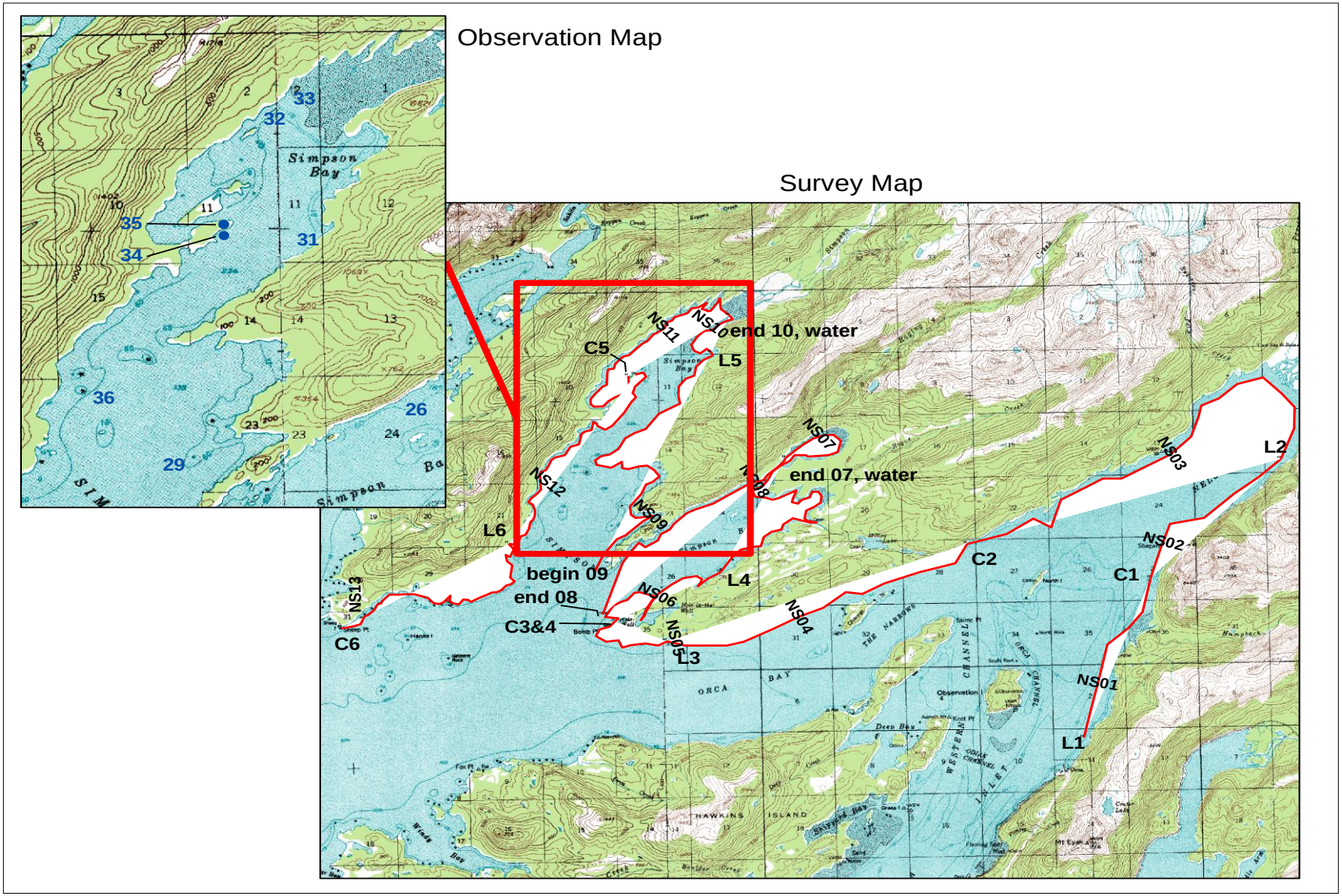
Survey Datasheet (example):

Trip: Nelson Simpson **Observers:** LK, DS

Trip Initials: NS

Water-Based Surveys							Shore-Based Surveys					
Transect ID	Date	Begin Time	Begin Waypoint	End Time	End Waypoint	Loc	Shore-based Survey ID	Date	Waypoint	Begin Time	End Time	Loc
NS01	29/7/07	1421	3	1702	6		NS_A	29/7/07	1	1303	1415	L1
NS02	30/7/07	1033	15	1258	16		NS_B	29/7	7	1813	1945	C1 (pm)
NS03	30/7/07	1405	18	1829	20		NS_C	30/7	7	0800	0912	C1 (am)
NS04	31/7	1120	27	1304	32		NS_D	30/7	17	1310	1400	L2
NS05	31/7	1400	36	1636	38		NS_E	30/7	21	1917	2038	C2 (pm)
NS06	01/8	1018	41	1244	44		NS_F	31/7	21	0936	1012	C2 (am)
NS07	01/8	1405	46	1508	47	water	NS_G	31/7	33	1313	1353	L3
NS08	01/8	1525	48	1902	49		NS_H	31/7	39	1750	1925	C3 (pm)
NS09	02/8	1035	51	1321	56		NS_I	01/8	39	0840	0913	C3 (am)
NS10	02/8	1425	59	1459	60	water	NS_J	01/8	45	1302	1356	L4
NS11	02/8	1521	61	1850	64		NS_K	01/8	39	2000	2052	C4 (pm)
NS12	03/8	1041	66	1313	68		NS_L	02/8	39	0824	0930	C4 (am)
NS13	03/8	1445	72	1814	77		NS_M	02/8	57	1335	1418	L5
							NS_N	02/8	65	1942	2107	C5 (pm)
							NS_O	03/8	65	0827	0915	C5 (am)
							NS_P	03/8	69	1330	1428	L6
							NS_Q	03/8	78	1841	1951	C6 (pm)
							NS_R	04/8	78	0817	0928	C6 (am)
							NS_S	04/8	78	1113	1236	C6

Map Examples: Observation maps and survey maps will be equal in size, but observation maps will be smaller in scale. Encounters are marked in BLUE on the observation map.



Appendix 1. Sustainable Activity images used in the workshops

Level of The following images were used in the workshops to show varying use densities rated from A to E. Level A always showed no vessels and are shown in the main body of the report. Levels B through E for Blackstone Bay, Unakwik Inlet and Sheep and Simpson Bays are shown here.

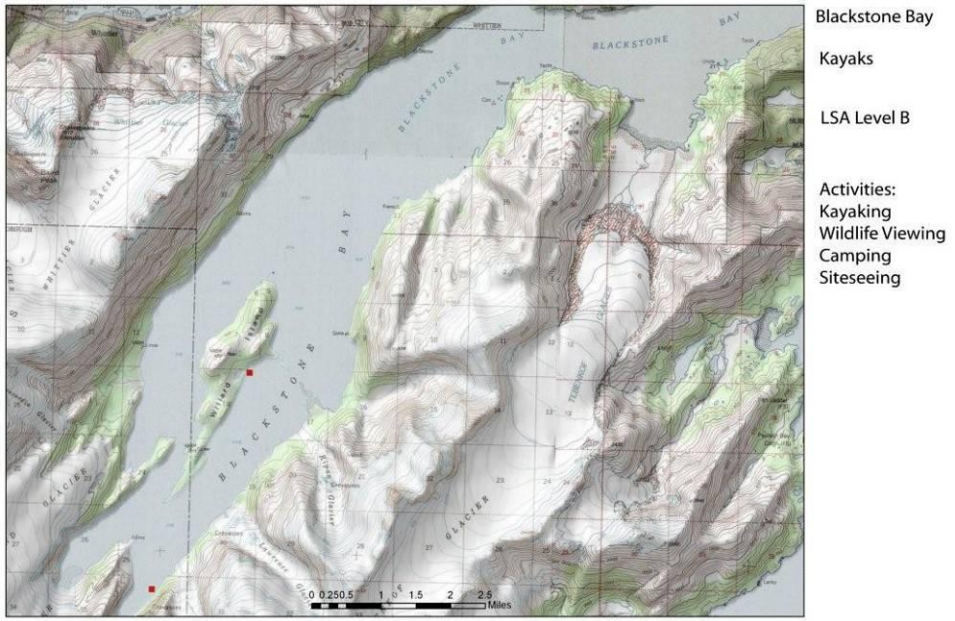


Figure 2 Blackstone Bay Kayaks LSA B

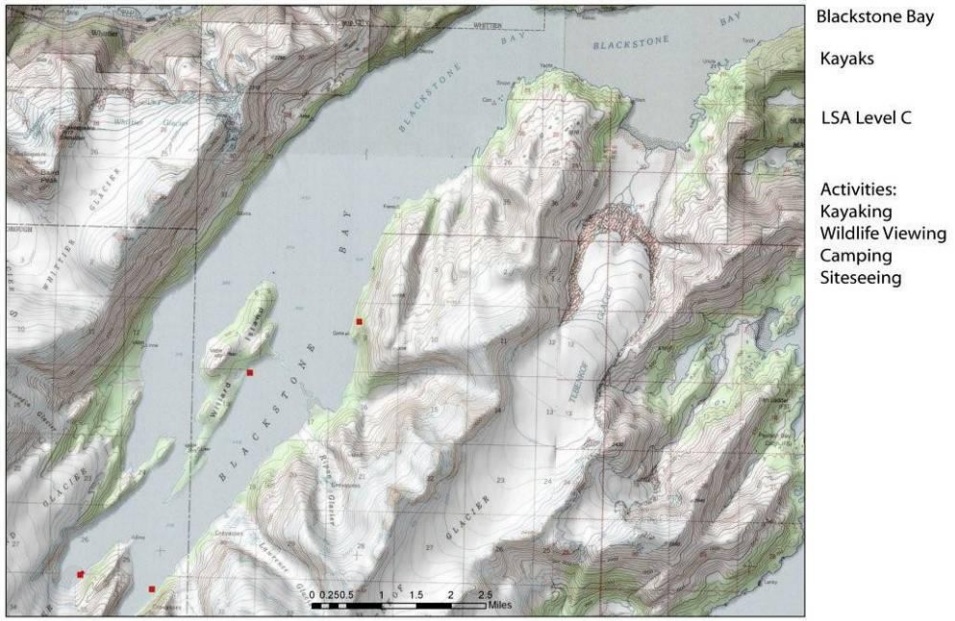


Figure 3 Blackstone Bay Kayaks LSA C

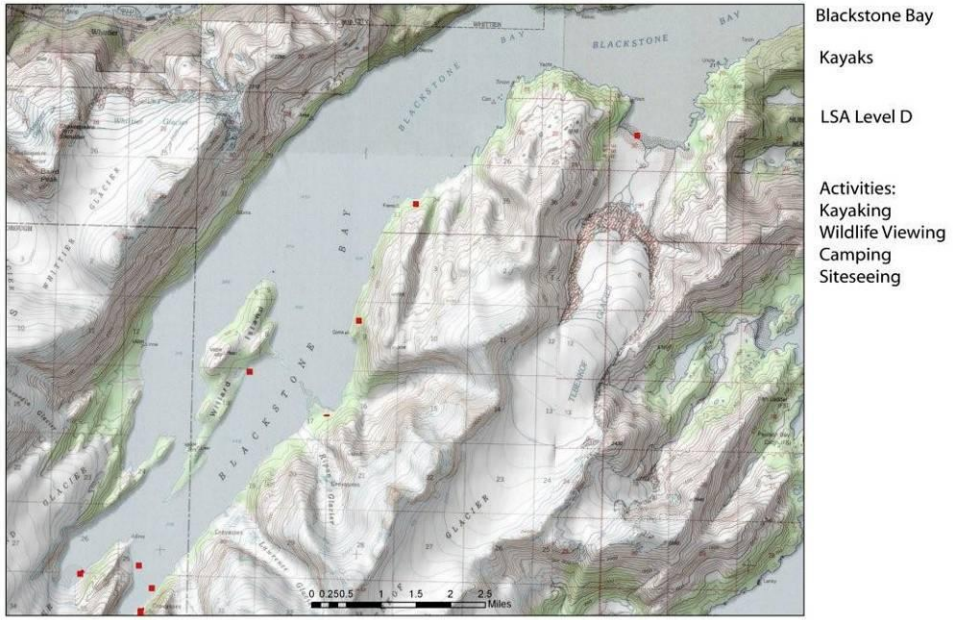


Figure 4 Blackstone Bay Kayaks LSA D

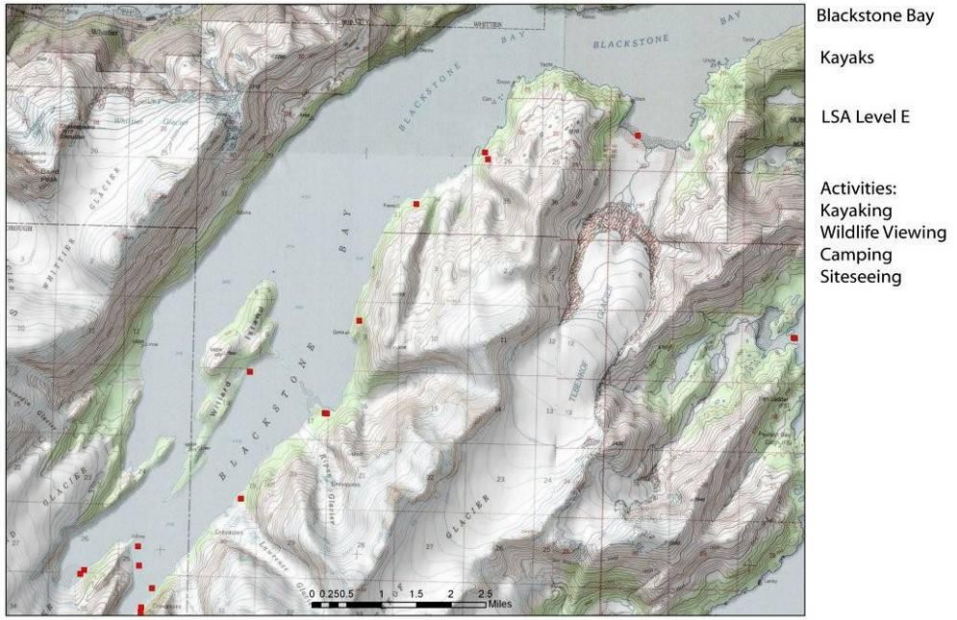


Figure 5 Blackstone Bay Kayaks LSA E

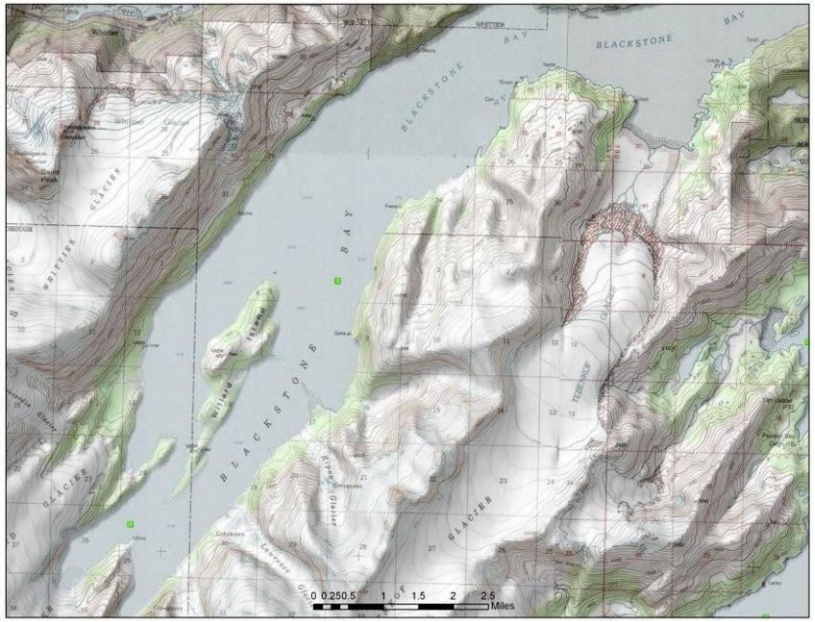


Figure 6 Blackstone Bay Motor Boats LSA Level B

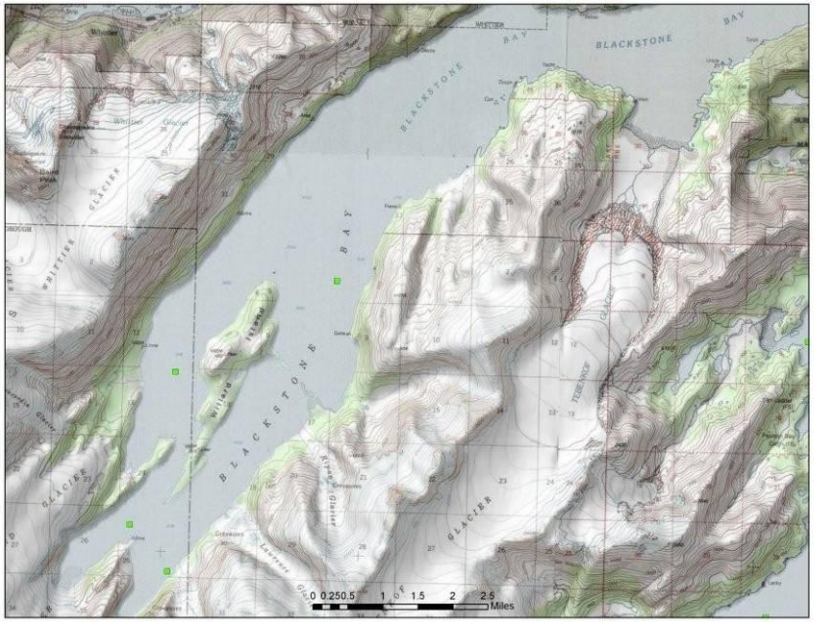


Figure 7 Blackstone Bay Motor Boats LSA Level C

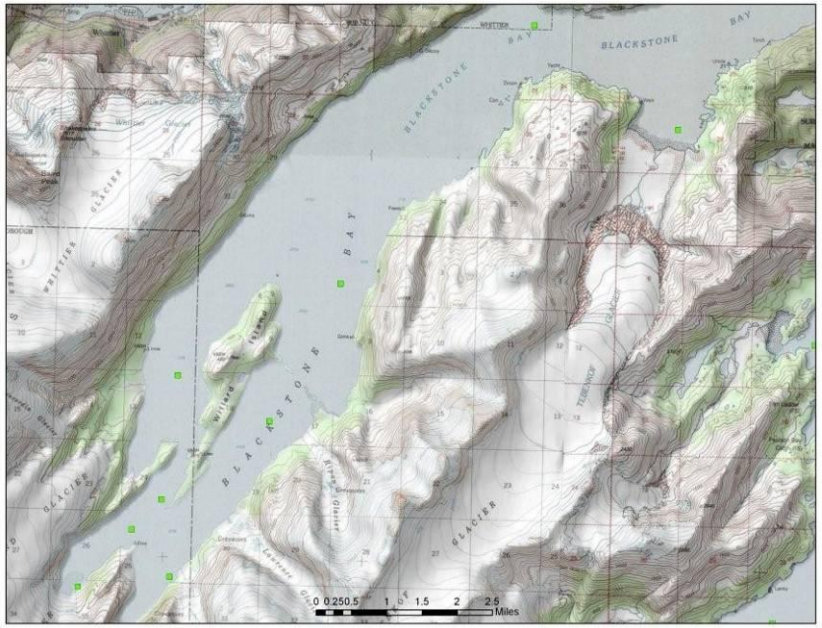


Figure 8 Blackstone Bay Motor Boats LSA Level D

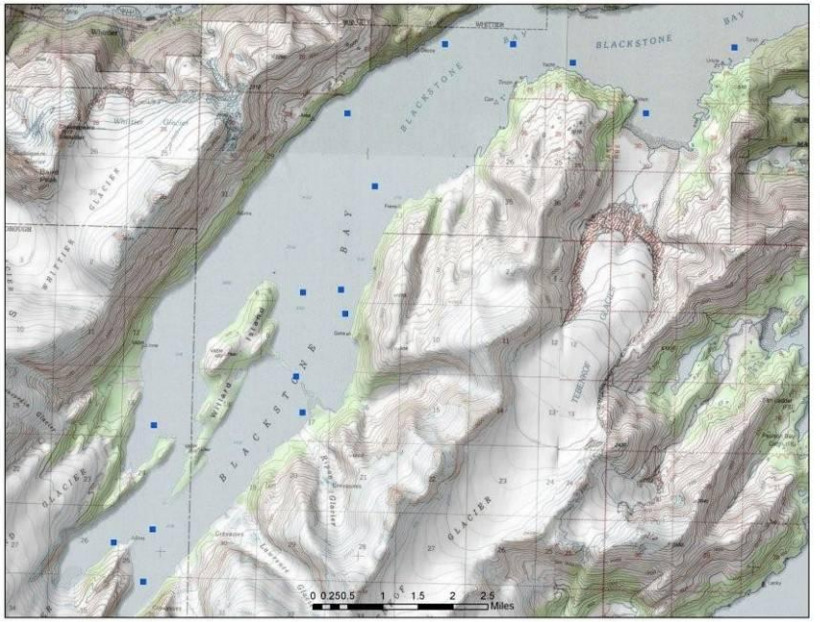


Figure 9 Blackstone Bay Motor Boats LSA Level E

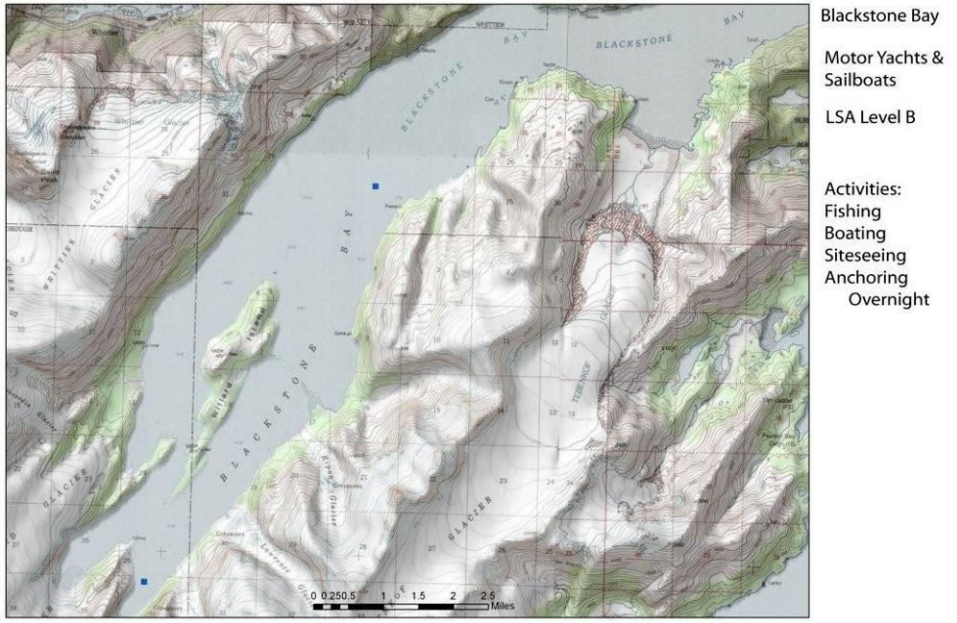


Figure 10 Blackstone Bay Motor Yachts and Sailboats LSA Level B

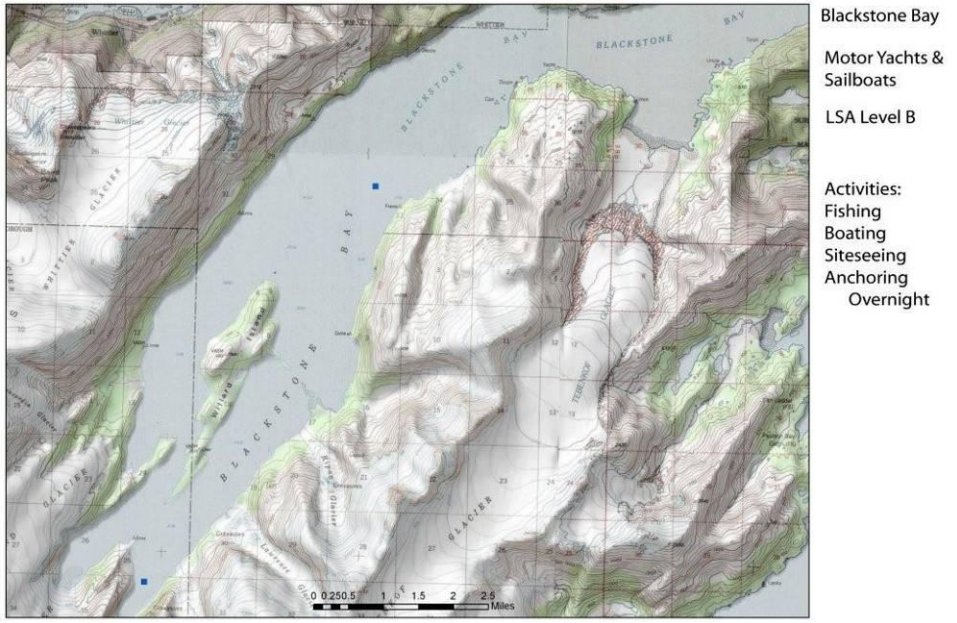


Figure 11 Blackstone Bay Motor Yachts and Sailboats LSA Level C

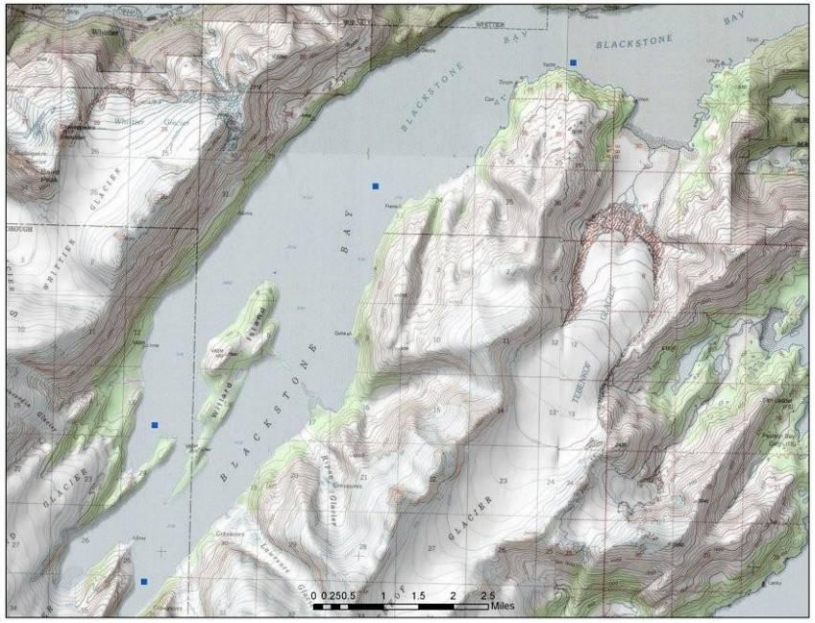


Figure 12 Blackstone Bay Motor Yachts and Sailboats LSA Level D

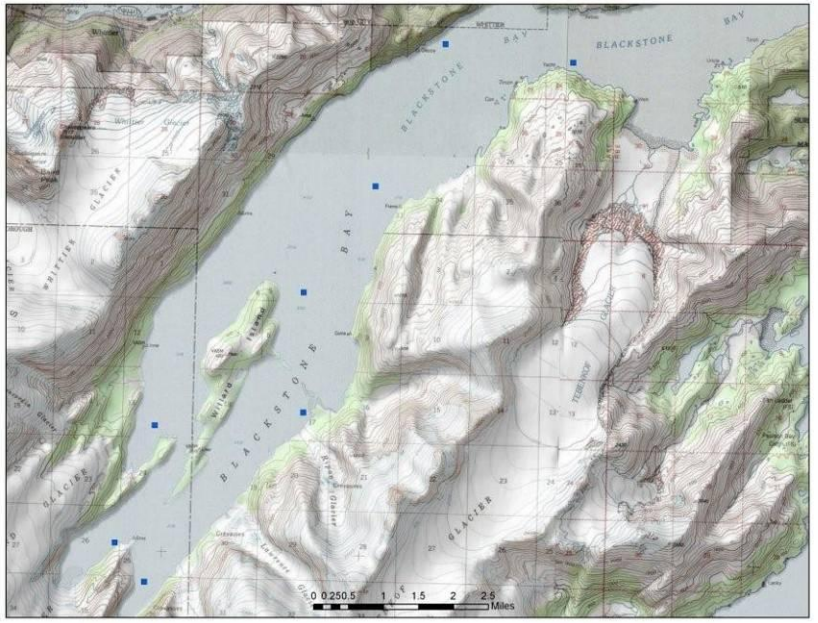


Figure 13 Blackstone Bay Motor Yachts and Sailboats LSA Level E

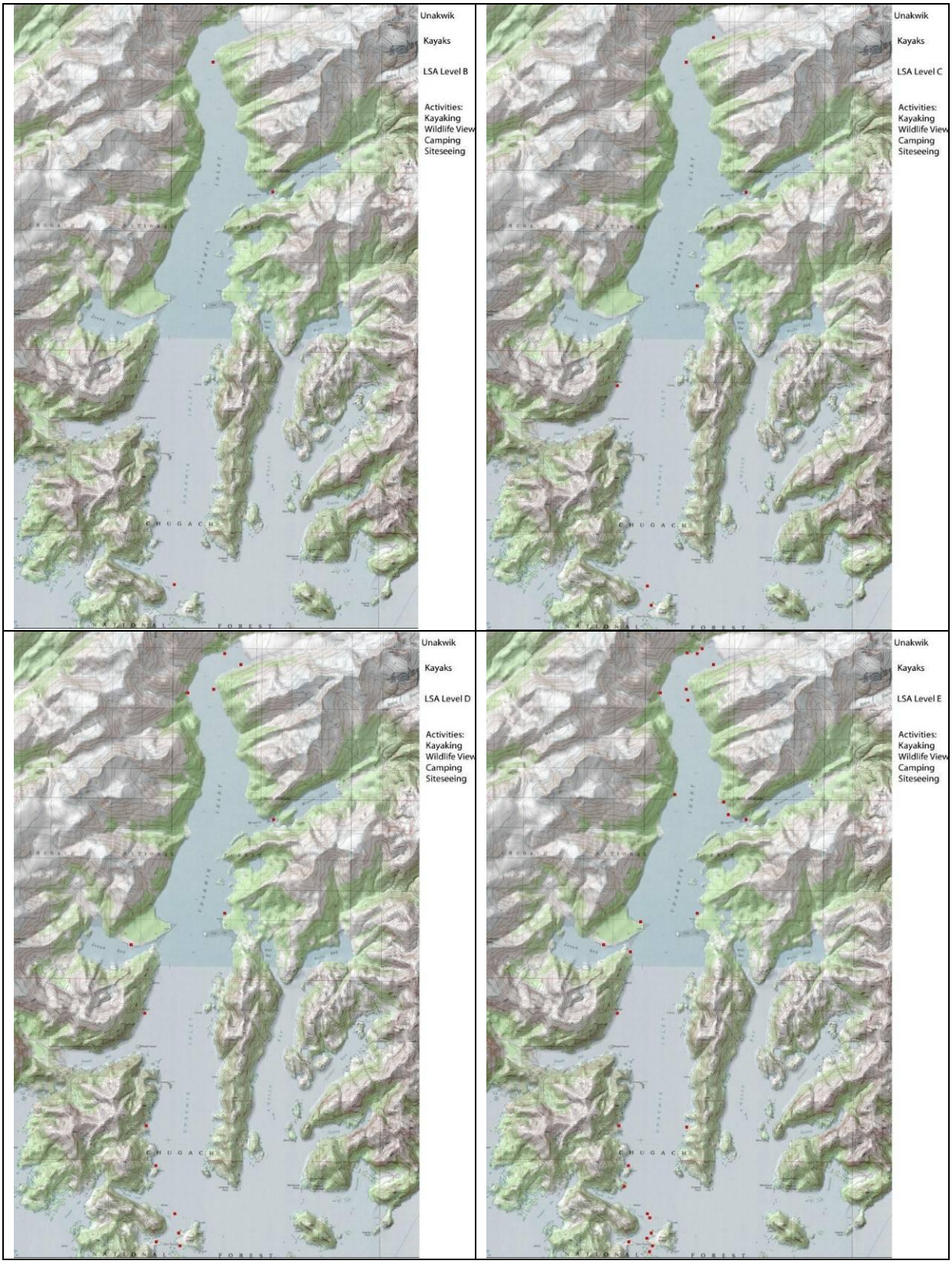


Figure 14 Unakwik Inlet Kayaks LSA Levels B, C, D & E

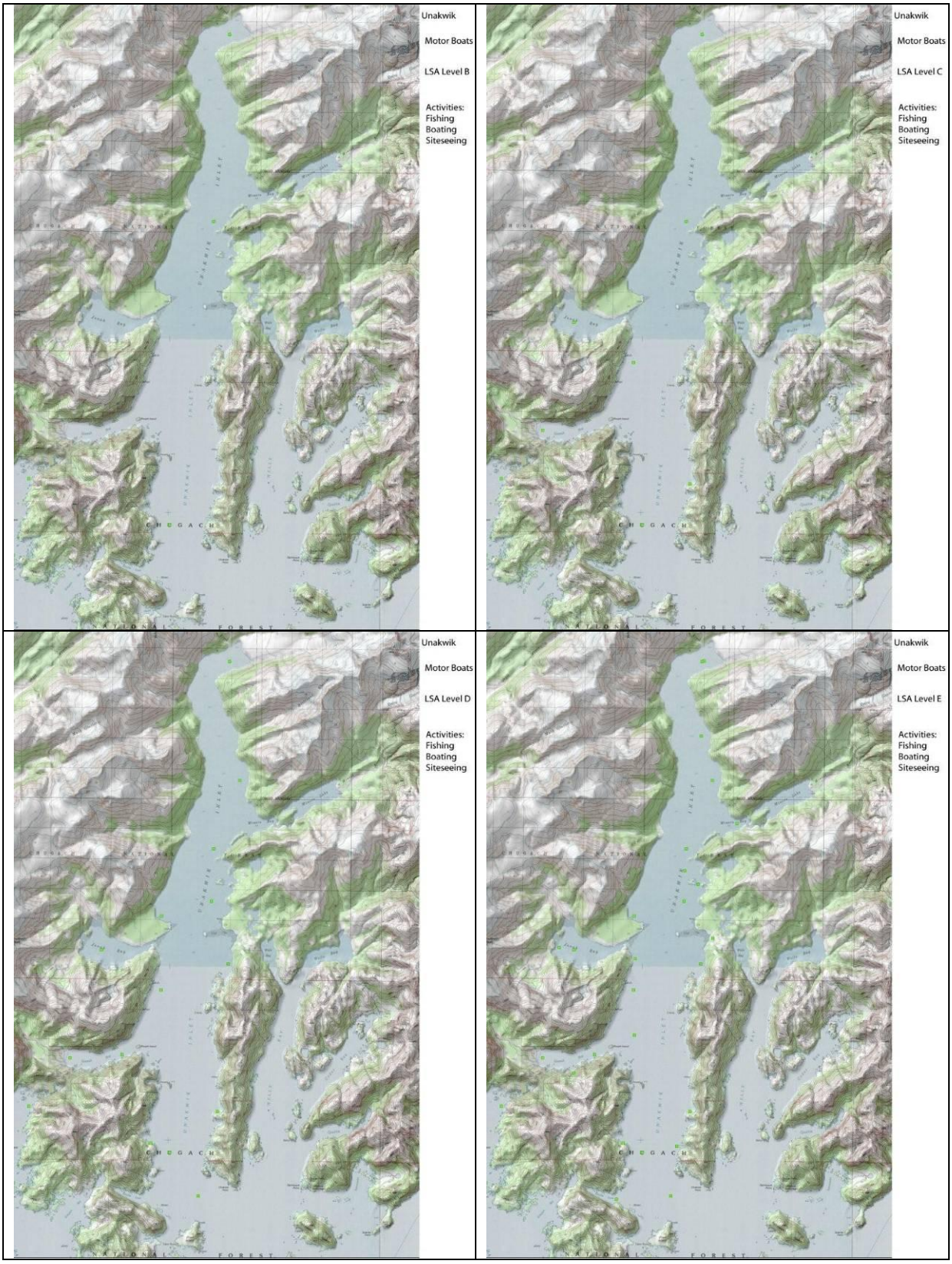


Figure 15 Unakwik Inlet Motor Boats LSA Levels B, C, D & E

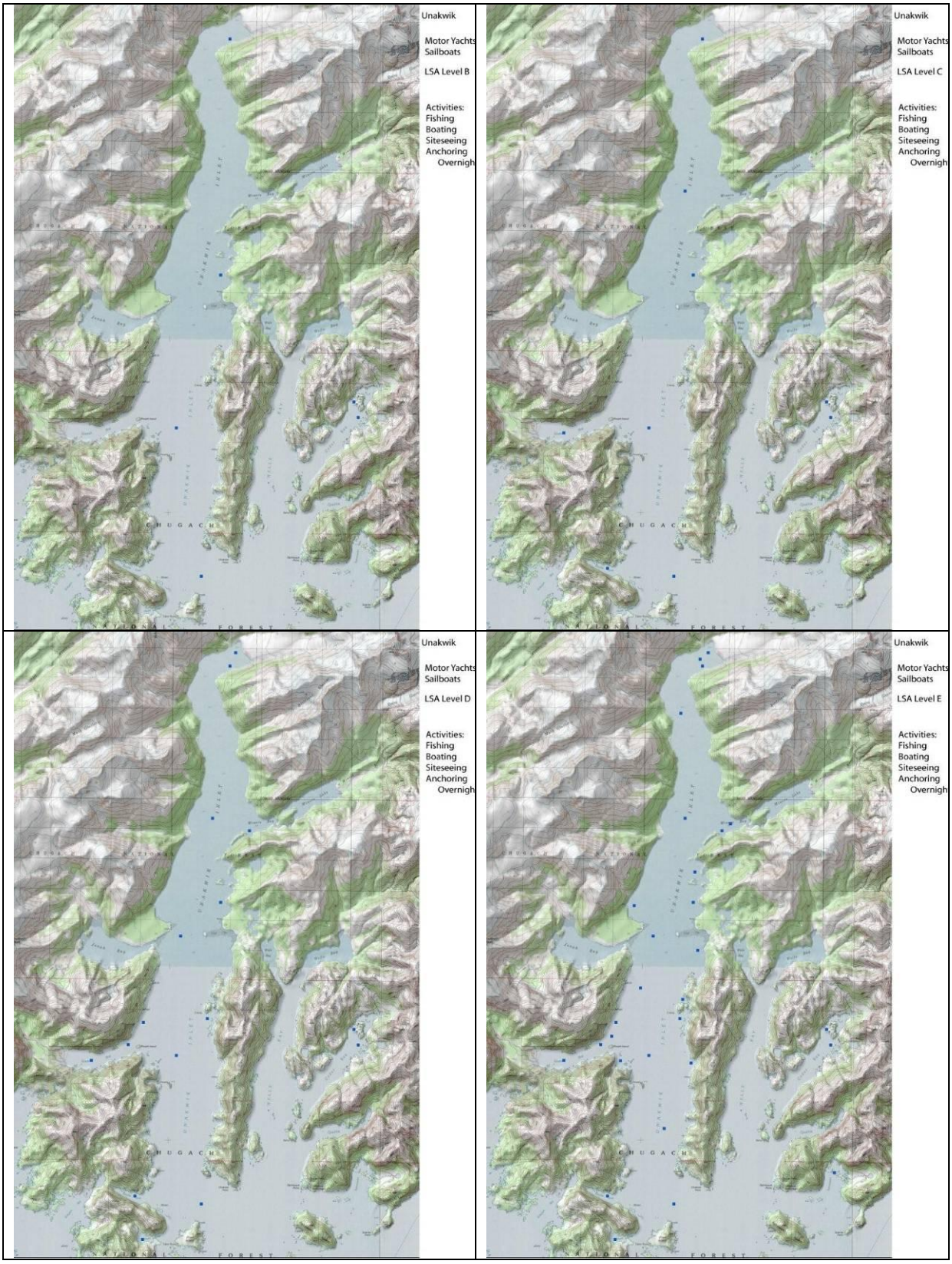


Figure 16 Unakwik Inlet Motor Yachts and Sailboats LSA Levels B, C, D & E

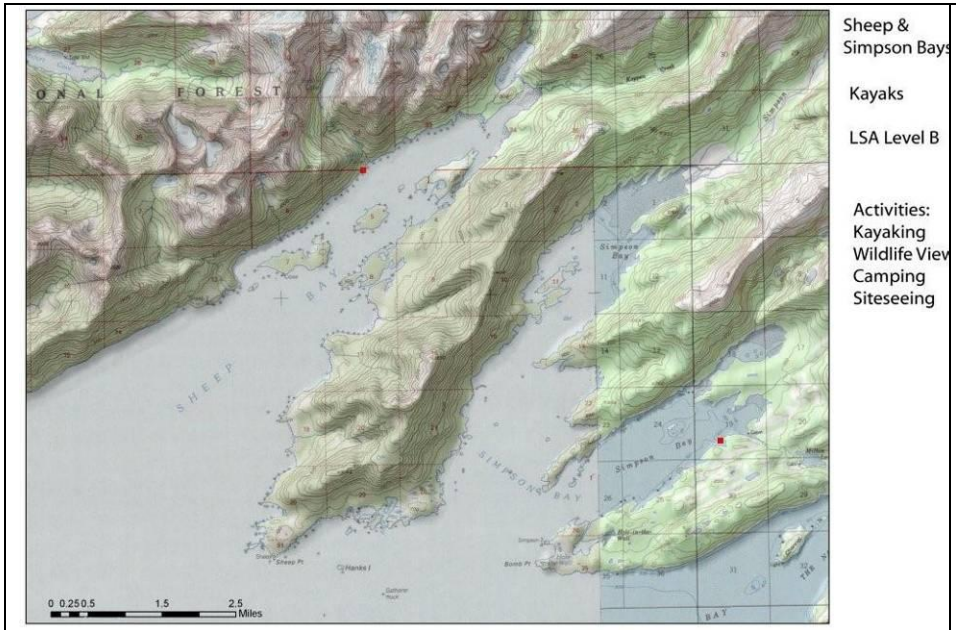


Figure 17 Sheep and Simpson Bays Kayaks LSA Level B

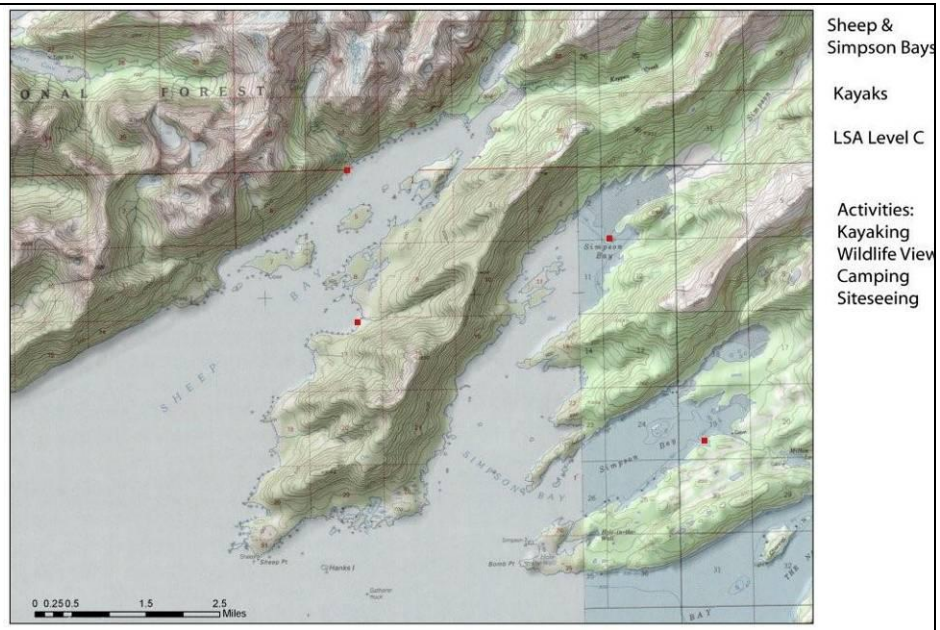


Figure 18 Sheep and Simpson Bays Kayaks LSA Level C

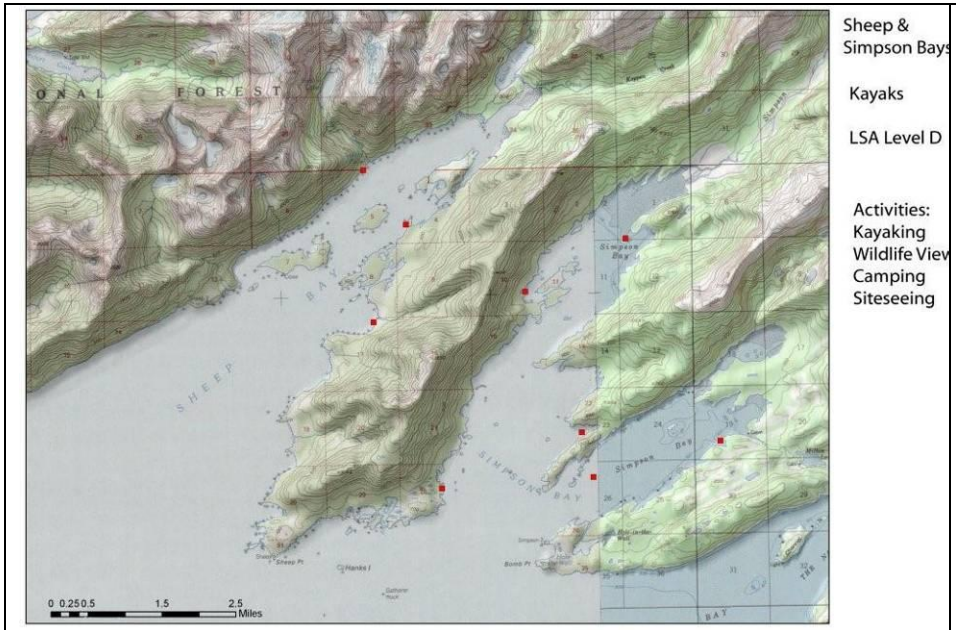


Figure 19 Sheep and Simpson Bays Kayaks LSA Level D

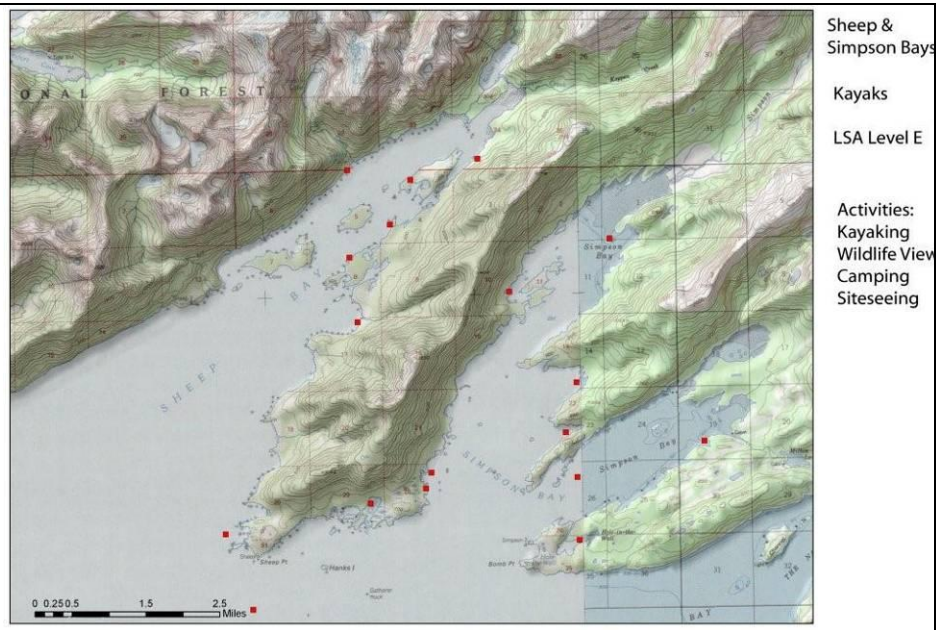


Figure 20 Sheep and Simpson Bays Kayaks LSA Level E

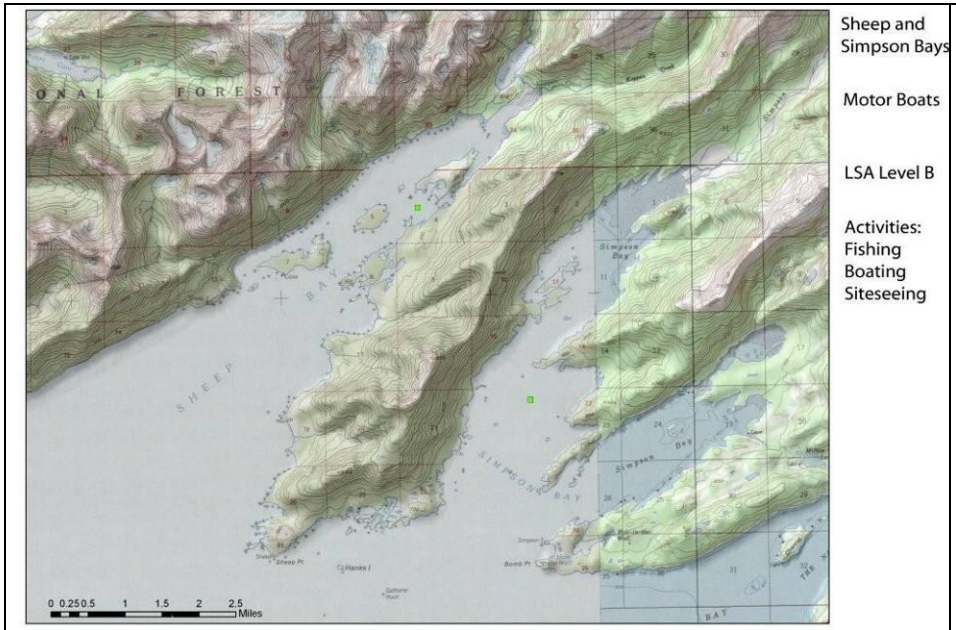


Figure 21 Sheep and Simpson Bays Motor Boats LSA Level B

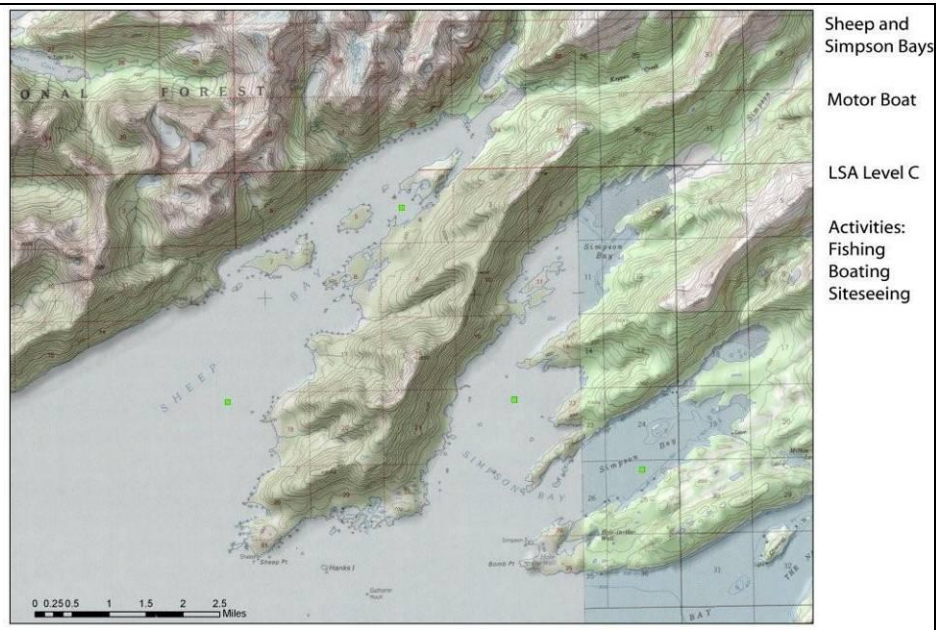


Figure 22 Sheep and Simpson Bays Motor Boats LSA Level C

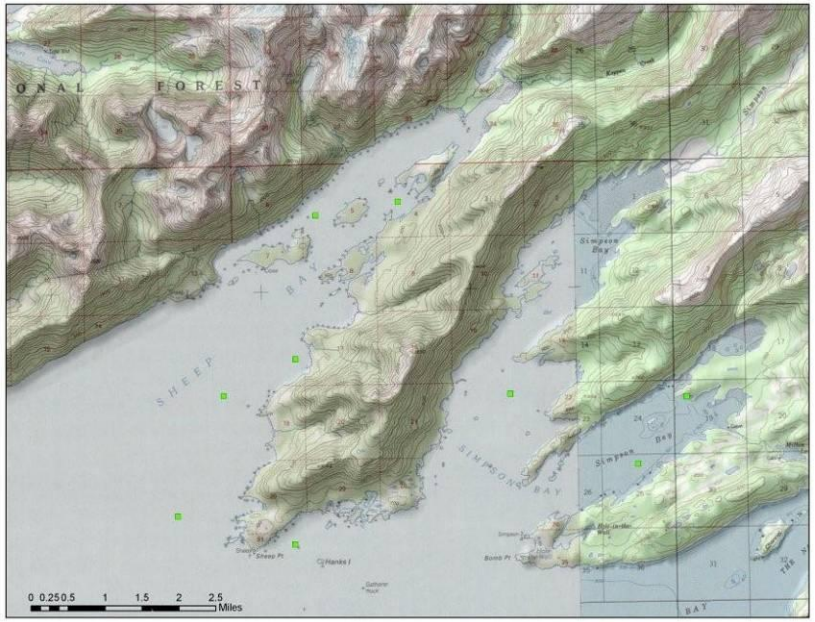


Figure 23 Sheep and Simpson Bays Motor Boats LSA Level D

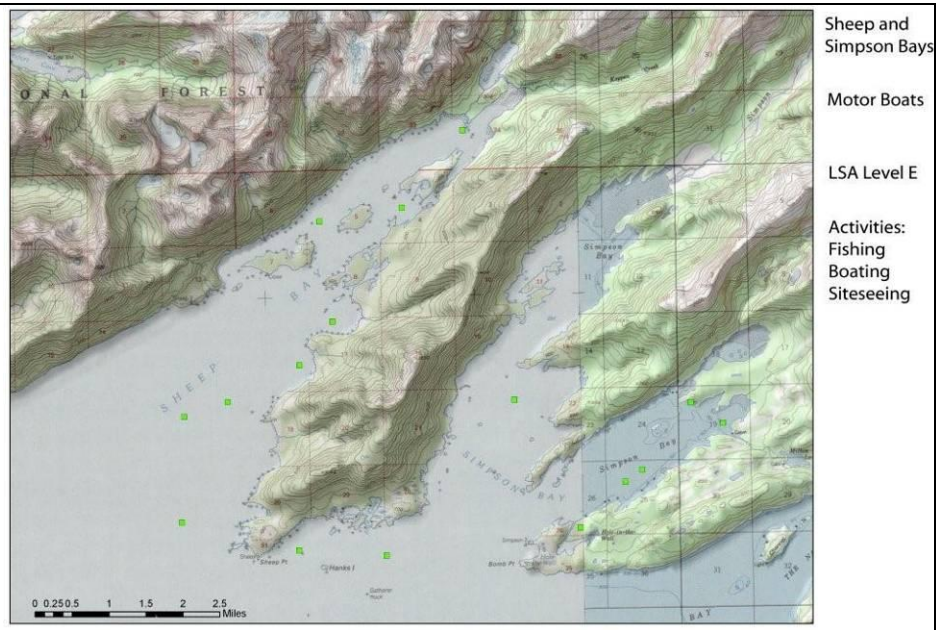


Figure 24Sheep and Simpson Bays Motor Boats LSA Level E

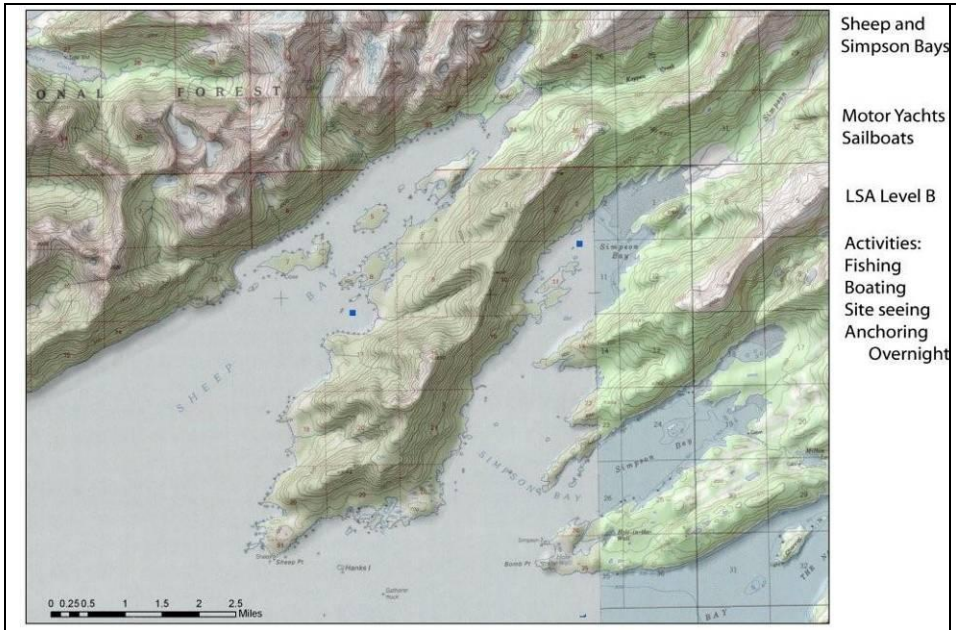


Figure 25 Sheep and Simpson Bays Motor Yachts and Sailboats LSA Level B

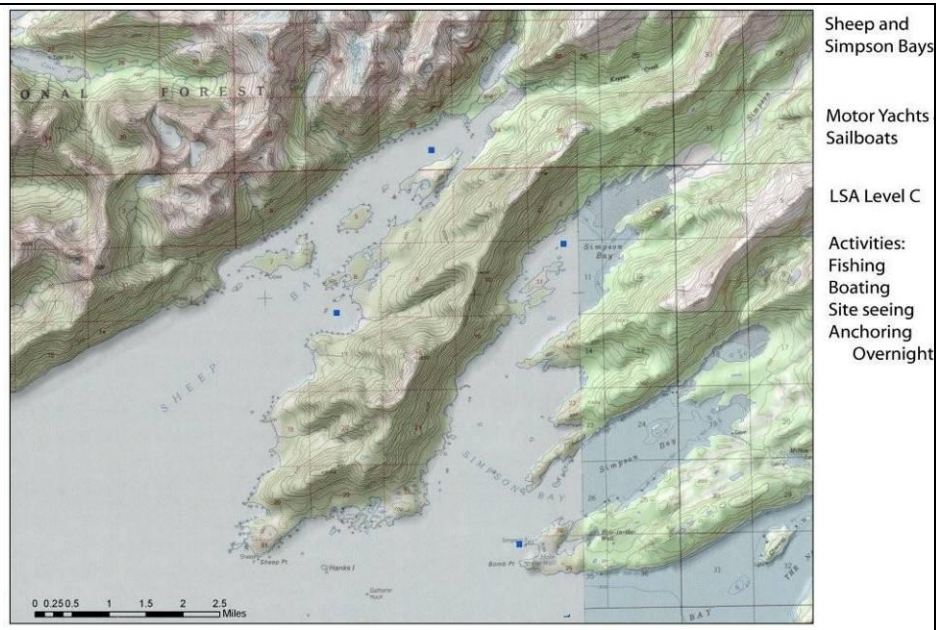


Figure 26 Sheep and Simpson Bays Motor Yachts and Sailboats LSA Level C

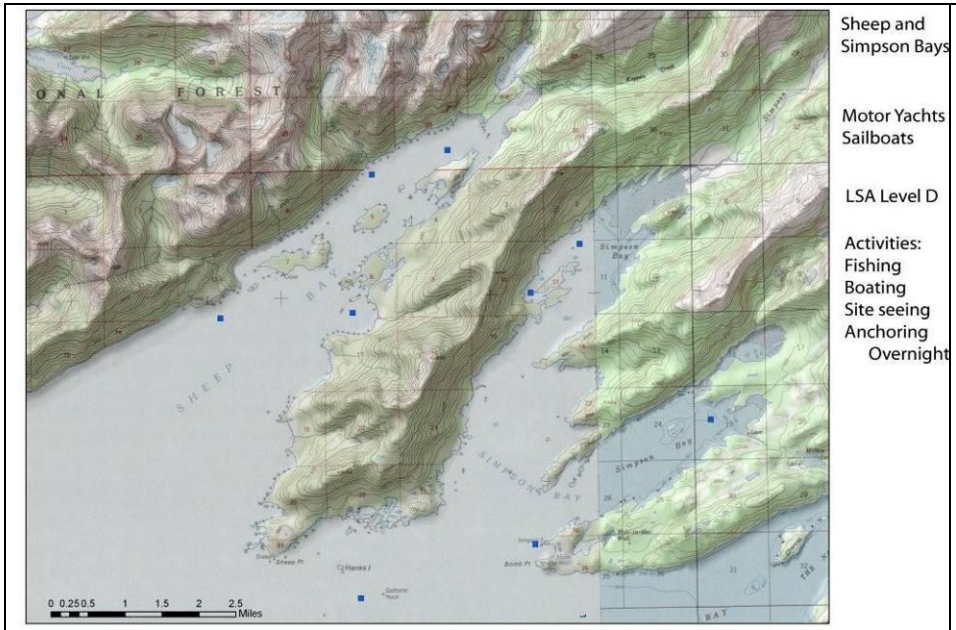


Figure 27 Sheep and Simpson Bays Motor Yachts and Sailboats LSA Level D

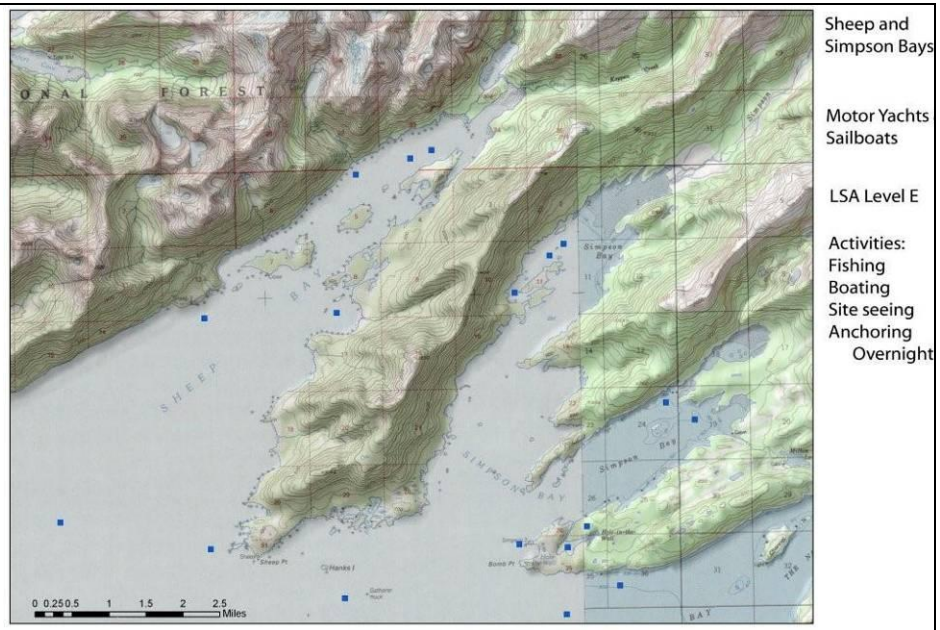


Figure 28 Sheep and Simpson Bays Motor Yachts and Sailboats LSA Level E

Appendix 3 Raw scores for LSA ratings in community workshops

	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays
	Kayaker Rating Kayaks			**Kayakers Rating Small Motorized Boats**			**Kayakers Rating Motor Yachts and Sailboats**		
	Ideal LSA			***Ideal LSA***			***Ideal LSA***		
Anchorage Kayakers	2a,2b	10a,1b	4b,7a	10a,1b	11a	8a,3b	11a	11a	9a,3b
Valdez Kayakers	3a,2a-b	4a,1b	5b	3a,1a-b,1b	1a,2a-b,1b	3a,2b	1a,1a-b,2b	2a,2b	4a,1b
Cordova Kayakers	5a,2b	4a,1b	6a,1c	7a	7a	6a,1b	6a	7a	6a,1b
	Expected Peak Season LSA			***Expected Peak Season LSA***			***Expected Peak Season LSA***		
Anchorage Kayakers	2c,1c-d,8d	1a,8b,1c	1a,3b,1b-c,1c	3b,7c	8b,2c	3b,4c,1e	2b,2b-c,7c	2a-b,6b	2b,7c
Valdez Kayakers	1c-d,4d	2a-b,2b	1b,4c	2c-d,3d	4b	5c	1b-c,3c	4b	5c
Cordova Kayakers	3c,2d	3a,2b	1a,3b,1c	1b,2c,3d	5b	6c,1d	2b,2c,1d	5b	7c
	Maximum Tolerable LSA			***Maximum Tolerable LSA***			***Maximum Tolerable LSA***		
Anchorage Kayakers	11d	6b,5c	1b,5c,5d	2b,7c,2d	6b,5c	8c,1d	1b,9c,1d	1a,9b	4b,6c
Valdez Kayakers	4c,1d	3b-c,c	5d	3c,2d	4c	3c,2d	4c	4c	3c,2d
Cordova Kayakers	5c,1d	3b,4c	4c,2d	1b,4c	6c,1d	1b,2c,4d	1a,1b,4c	1a,4b,2c	1b,4c,2d

Table 2 Raw scores for LSA ratings in community workshops - Kayakers

	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays
	Recreational Boaters Rating Kayaks			**Recreational Boaters Rating Small Motorized Boats**			**Recreational Boaters Rating Motor Yachts and Sailboats**		
	Ideal LSA			***Ideal LSA***			***Ideal LSA***		
USFS Managers	2a,1b,1c,3d	4a,3b,1c	1b,2c,2d	5a,2b,1c	2a,4b	4a,2b,2c	3a,4b	5a,4b	6a,2b
Anchorage Boaters	12a	3a,9b	12a	12a	4a,8b	12a	12a	11a,1b	12a
Valdez Boaters	3c,1d	1a,3b	1a,3b	1a,1b,2d	1a,3b	2a,1b,1c-d	4a	2a,2b	1a,2b,1c
Cordova Boaters	5a	1a,4b	6a	4a,1b	5b	6a	5a	3a,3b	5a
	Expected Peak Season LSA			***Expected Peak Season LSA***			***Expected Peak Season LSA***		
Anchorage Boaters	1c,3d	4a	2a,5b,1d	1c,3e	4a,1b	1b,2c,2d	3b,1c	6a	5c
Anchorage Boaters	3c,9d	1b,11c	1a,8b,1c	12c	a0c,2d	8c,2d	10c,2d	4a,6b	2b,9c
Valdez Boaters	1b,2c,1d	4b	1a,1a-b,2b	4d	3b,1c	3c,1d	4a	4b	2b,2c
Cordova Boaters	3e	1b,2d	1b,2c,2d	1d,1d-e,1e	3d	3d	3e	3c	1b,2c
	Maximum Tolerable LSA			***Maximum Tolerable LSA***			***Maximum Tolerable LSA***		
Anchorage Boaters	2a,1b,1c,4d	6c,3d	6c,3d	2c,4d,1e	1b,5c,3d	1c,7d,1e	2b,3c,2d	4b,4c	1b,5c,1d
Anchorage Boaters	1c,7d,4e	1c,9d,2e	5c,5d,2e	4c,6d,2e	1b,7c,3d	4c,5d,1e	4c,6d,2e	6b,4c,2d	1b,7c,4d
Valdez Boaters	2c,2d	2c,2d	1b,2c,2d	2d,2e	1b,2c,1d	2d,2e	2a,2b	4c	4c
Cordova Boaters	3e	3d	2d,1e	2c,1d	1c,2d	1c,1c-d,1d	2d,1e	1b,2c	2d,1e

Table 3 Raw scores for LSA ratings in community workshops - Recreational Boaters

	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays	Blackstone Bay	Unakwik Inlet	Sheep and Simpson Bays
	Hunters Rating Kayaks			**Hunters Rating Small Motorized Boats**			**Hunters Rating Motor Yachts and Sailboats**		
	Ideal LSA			***Ideal LSA***			***Ideal LSA***		
Anchorage Hunters	3a	3a	2a,1b	3b	3a	3a	3a	3a	3a
Valdez Hunters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cordova Hunters	5a	1a,4b	6a	4a,1b	5b	6a	5a	3a,3b	5a
	Expected Peak Season LSA			***Expected Peak Season LSA***			***Expected Peak Season LSA***		
Anchorage Hunters	3c	3b	N/A	3e	3d	2c	3b	3b	3c
Valdez Hunters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cordova Hunters	No Rating	5a	3a,3b	3e	4b,2c	4b,2c	No Rating	4b,1c	5c
	Maximum Tolerable LSA			***Maximum Tolerable LSA***			***Maximum Tolerable LSA***		
Anchorage Hunters	2b,1c	3b	1b,2c	3b	3b	2c,1d	3b	3a	3b
Valdez Hunters	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cordova Hunters	No Rating	2b,4c	Uncertain	5c	1b,5c	6c	No Rating	2b,4c	1c,4d

Table 4 Raw scores for LSA ratings in community workshops - Hunters